United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Michigan Department of
Agriculture, Michigan
Agricultural Experiment
Station, and Michigan
Technological University

Soil Survey of Houghton County Area, Michigan

How To Use This Soil Survey

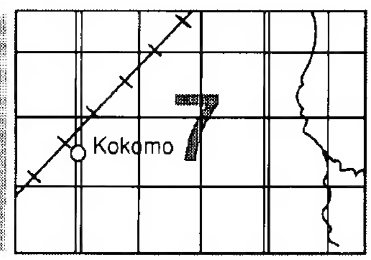
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

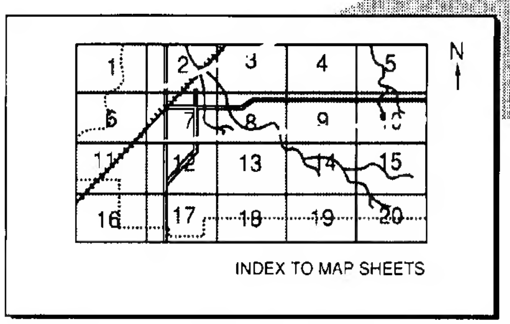
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



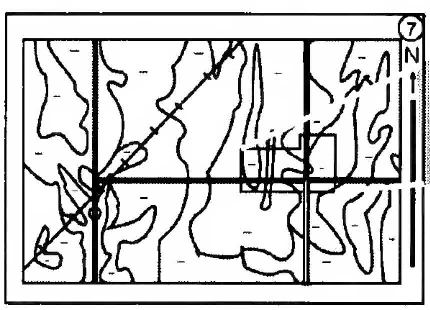
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



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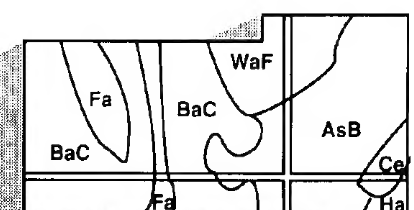

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1988. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This survey was made cooperatively by the Soil Conservation Service and the Michigan Department of Agriculture, the Michigan Agricultural Experiment Station, and Michigan Technological University. It is part of the technical assistance furnished to the Houghton Soil and Water Conservation District. Financial assistance was provided by the Houghton County Board of Commissioners.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Typical area of the Halfaday-Au Gres-Roscommon association (foreground) and of the Munising-Abbaye-Kalkaska association (background).

Contents

Issued October 1991

Index to Map Units

Summary of Tables

Preface

This soil survey contains information that can be used in land-planning programs in Houghton County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Soil Survey of Houghton County Area, Michigan

By Charles Schwenner, Soil Conservation Service

Fieldwork by Loren Berndt, Charles Schwenner, David White, and Kenneth Wikgren, Soil Conservation Service, and Dennis Robinson and Thomas Bauer, Michigan Department of Agriculture

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Michigan Department of Agriculture, the Michigan Agricultural Experiment Station, and Michigan Technological University

HOUGHTON COUNTY is located on the Keweenaw Peninsula in the western part of the Upper Peninsula of Michigan (fig. 1). It borders Lake Superior. It has an area of 667,904 acres, or about 1,044 square miles. The survey area is 497,952 acres, or about 778 square miles. It does not include the federal land within the boundaries of the Ottawa National Forest, in the southern part of the county. The population of Houghton County was 36,100 in 1987. The city of Houghton is the county seat.

About 82 percent of the county is forested. Only about 7 percent is classified as farmland. Retail trade and the service industry are the major employers.

About 152 different kinds of soil are in the survey area. The soils vary widely in texture, natural drainage, slope, and other characteristics. Because of steep slopes, droughtiness, and rockiness, many of the soils are best suited to woodland. The subsoil in most of the moderately well drained soils has a restrictive layer that limits the use of forestry equipment and residential development. About 10 percent of the survey area is poorly drained mineral soils and very poorly drained organic soils.

Figure 1.—Location of Houghton County in Michigan.

General Nature of the County

This section gives general information about the county. It describes climate, history and development,

physiography, lakes and streams, farming, and industry and transportation facilities.

Climate

Prepared by the Michigan Department of Agriculture, Climatology Program, East Lansing, Michigan.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Houghton/Calumet and Kenton in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 15.8 degrees F at Houghton/Calumet and 14.4 degrees F at Kenton and the average daily minimum temperature is 9.2 degrees at Houghton/Calumet and 3.4 degrees at Kenton. The lowest temperature on record is -35 degrees at Houghton/Calumet and -46 degrees at Kenton. In summer, the average temperature is 62.3 degrees at Houghton/Calumet and 63.3 degrees at Kenton and the average daily maximum temperature is 72.3 degrees at Houghton/Calumet and 77.5 degrees at Kenton. The highest recorded temperature is 102 degrees at Houghton/Calumet and 100 degrees at Kenton.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 34.13 inches at Houghton/Calumet and 30.31 inches at Kenton. Of these totals, 17.74 inches at Houghton/Calumet and 20.71 inches at Kenton usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14.2 inches at Houghton/Calumet and less than 16.7 inches at Kenton. The heaviest 1-day rainfall on record was 3.58 inches at Houghton/Calumet on May 17, 1896, and 5.45 inches at Kenton on July 14, 1980. Thunderstorms occur on about 27 days each year at Houghton/Calumet and on about 31 days each year at Kenton.

The average seasonal snowfall is 207.8 inches at Houghton/Calumet and 104.6 inches at Kenton. The greatest snow depth at any one time during the period of record was 53 inches at Houghton/Calumet and 55 inches at Kenton. On the average, 155 days of the year at Houghton/Calumet and 145 days at Kenton have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 65 percent. Humidity is higher at night, and the average at dawn is about 76 percent. The sun shines 63 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the west. Average windspeed is highest, 9.1 miles per hour, in December.

History and Development

When the first Europeans explored the Keweenaw Peninsula in 1621, it was inhabited by the Chippewa Indians. However, these Indians were preceded by a prehistoric race that mined the area's rich copper deposits. These deposits were later explored and documented by Dr. Douglas Houghton, State Geologist of Michigan. His report to the state legislature in 1841 about the rich mineral deposits of the area led to the "Great Michigan Copper Rush" of 1843.

The first large-scale mining operation in the county was the Quincy Mining Company, which was organized in 1848. In the succeeding decades, at least twenty major mining companies were established and the county grew and prospered. In 1910, it had a population of 88,000 and was Michigan's fourth largest county *(14)*. Several other industries also grew during this period. In 1934, 2,000 farms in the county produced dairy products and vegetables for the area's population. The area's virgin timber also was harvested to build the mining industry and adjoining communities. Shipping and commerce also thrived as the copper was processed and transported to world markets.

Following World War I, western competition, lower copper prices, and a reliance on a poorer grade of copper signaled an end to Michigan's copper boom. Mining efforts continued through the post-World War II period, but production was insignificant compared to earlier periods. In 1968, the county's largest copper producer, the Calumet and Hecla Mining Company, halted its production.

Although the mining industry has declined in the survey area, tourism has become an important industry. Michigan Technological University, with an enrollment of over 7,000, and Suomi College, with an enrollment of 500, have also helped to stabilize the area's economy and development.

Physiography

Prepared by Ken Wikgren, soil scientist, So l Conservation Service.

The topography in the survey area ranges from steep, rocky ridges and dissected glacial deposits to gently sloping lake plains and nearly level outwash plains. Elevation ranges from 1,200 to 1,500 feet above sea level to about 602 feet at the Lake Superior shoreline. The bedrock geology and glacial activity have played key roles in shaping the region.

Bedrock geology consists of eight major stratigraphic units: the Portage Lake Lava Series, Copper Harbor conglomerate, Nonesuch shale, Freda sandstone, Jacobsville sandstone, Black River Group, South Range Series, and Michigamme slate *(8)* (fig. 2).

The Portage Lake Lava Series is of Middle Keweenawan age. It consists of basalt and andesite lava flows interbedded with conglomerates. Native copper has filled cavities and pore spaces in the series, forming the largest deposit of native copper in the world. The Copper Harbor conglomerate overlies the Portage Lake Lava Series. The Nonesuch shale and Freda sandstone are of Upper Keweenawan age and overlie the Copper Harbor conglomerate. The Nonesuch consists of dark shale and siltstone. The Freda consists of alternating layers of fine, arkosic sandstone and red, micaceous, silty shale.

The Jacobsville sandstone is of Upper Keweenawan or Cambrian age. It consists of a succession of red to white, coarse grained to fine grained feldspathic and quartzose sandstone with layers of shale and conglomerate. The Black River Group, of Ordovician age, consists of limestone and dolomite. It occurs in Houghton County as an isolated remnant known as Limestone Mountain, which overlies the Jacobsville sandstone.

The South Range Series, of Lower Keweenawan age, consists primarily of basalt lava flows. It occurs in a small area near the southwest corner of Houghton County and at Silver Mountain. The Michigamme slate, of Upper Huronian (Animikie) age, consists of slate and graywacke. It underlies the Jacobsville sandstone in the southeast corner of Houghton County.

The Keweenaw Fault has had a significant impact on the landscape of the Keweenaw Peninsula. The Keweenaw Fault is a major reverse fault that separates the Portage Lake Lava Series from the more or less flat Jacobsville sandstone. The Portage Lake Lava Series dips 25 degrees northwest under Lake Superior and emerges on Isle Royale 50 miles away. The beds have much steeper dips, as much as 70 degrees northwest, near the Keweenaw Fault. It is this central highland, which rises 700 feet above Lake Superior on the upthrust side of the Keweenaw Fault, that comprises the Copper Range.

The rugged hills of the Copper Range, once great mountains, are now 1,100 to about 1,500 feet above sea level. The Portage Lake Lava Series consists of more resistant rocks than the more easily weathered Jacobsville sandstone. The bedrock may have influenced the path and extent of glacial advances during the great ice ages.

The glacial drift in Houghton County was deposited by the Valder's advance of the Keweenaw Bay Sublobe of the Superior Lobe *(5)*. Although the Keweenaw Peninsula was glaciated many times during the Pleistocene Epoch, almost all traces of earlier glaciation have been obliterated. This relatively thin layer of drift tends to reflect the bedrock over which the glacier passed.

The Keweenaw Bay Lobe spread west across the Keweenaw Peninsula, southwest to Ontonagon County, and southeast onto the highlands in Baraga County *(3)*. The final advance was about 10,200 years ago *(13)*. As the glacier melted, a series of proglacial lakes formed from ponded meltwater. These marginal lakes merged to form Glacial Lake Duluth, which at its highest level of 1,280 feet above sea level covered most of ice-free Houghton County *(13)*. As the lake lowered, beach deposits were left on the western slopes of the Copper Range. The absence of these beach deposits on the eastern side of the county indicates that it remained ice covered. The Nipissing Great Lakes stage left a prominent shoreline at 628 feet and was the last major proglacial lake to influence the Pleistocene deposits of Houghton County *(6)*.

The surficial geology of Houghton County is a complex of ground moraines, end moraines, outwash deposits, glacial lake shorelines, and lake outlet channels, all with related deposits (figs. 3 and 4). The present topography is a result of glacial erosion and deposition, glacial lake processes, and, finally, subaerial erosion following melting of the ice and drainage of the lakes. Many landscapes have been heavily dissected by drainageways. The surficial veneer is probably related to wave action during the lowering of glacial lake levels and proglacial alluvial, colluvial, and eolian activity.

The area to the east of the Keweenaw Fault is a rolling ground moraine that has some areas of lacustrine deposits and is underlain by Jacobsville sandstone. The reddish brown sandy loam glacial till on this moraine strongly reflects the Jacobsville sandstone. The till to the south has also been influenced by

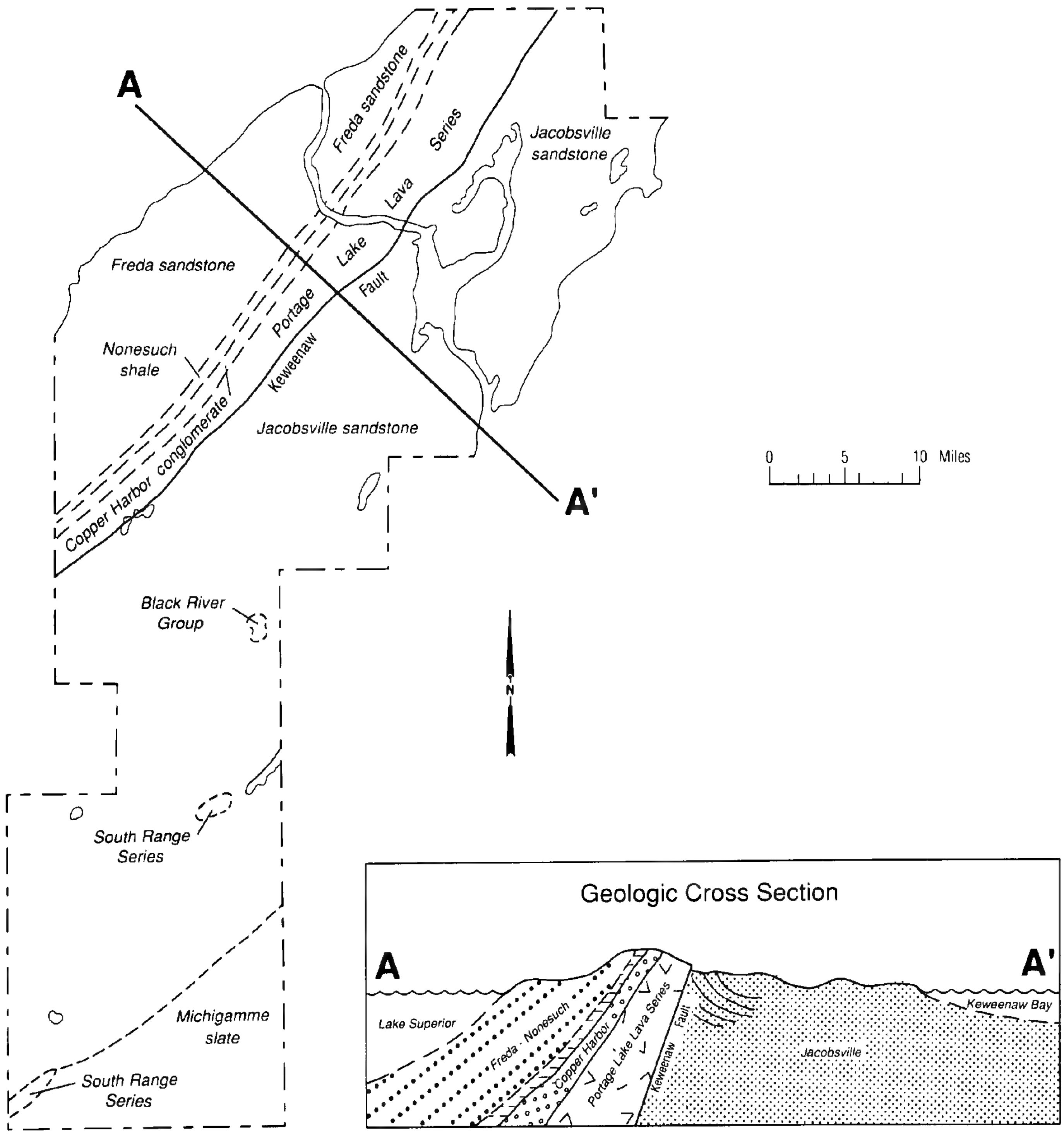

Figure 2.—Generalized bedrock geology of Houghton County. Modified after Martin, 1936 *(9)*, and Kelley, 1968 *(8)*.

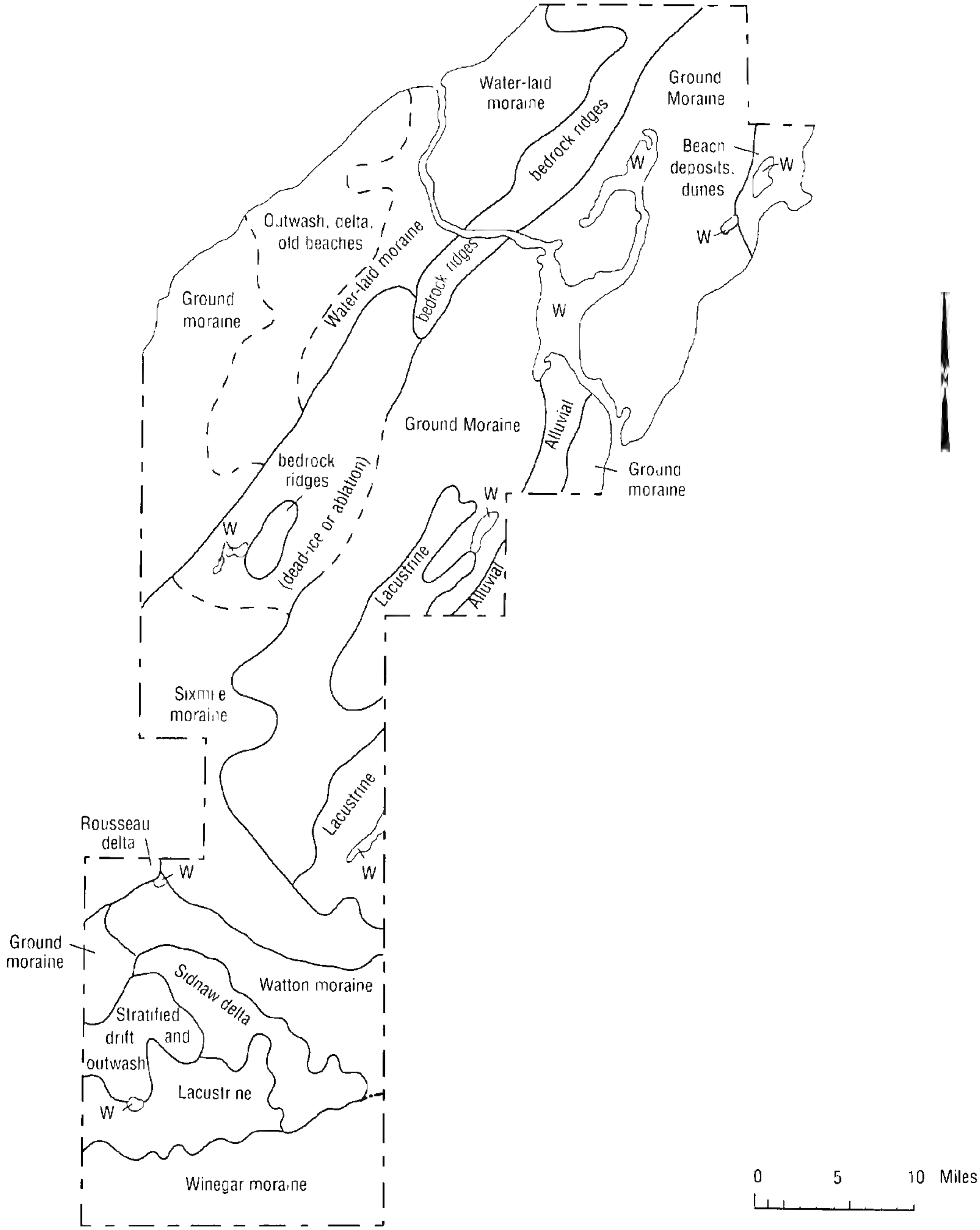

Figure 3.—Dominant glacial landforms of Houghton County. Modified after Peterson, 1985 *(13)*.

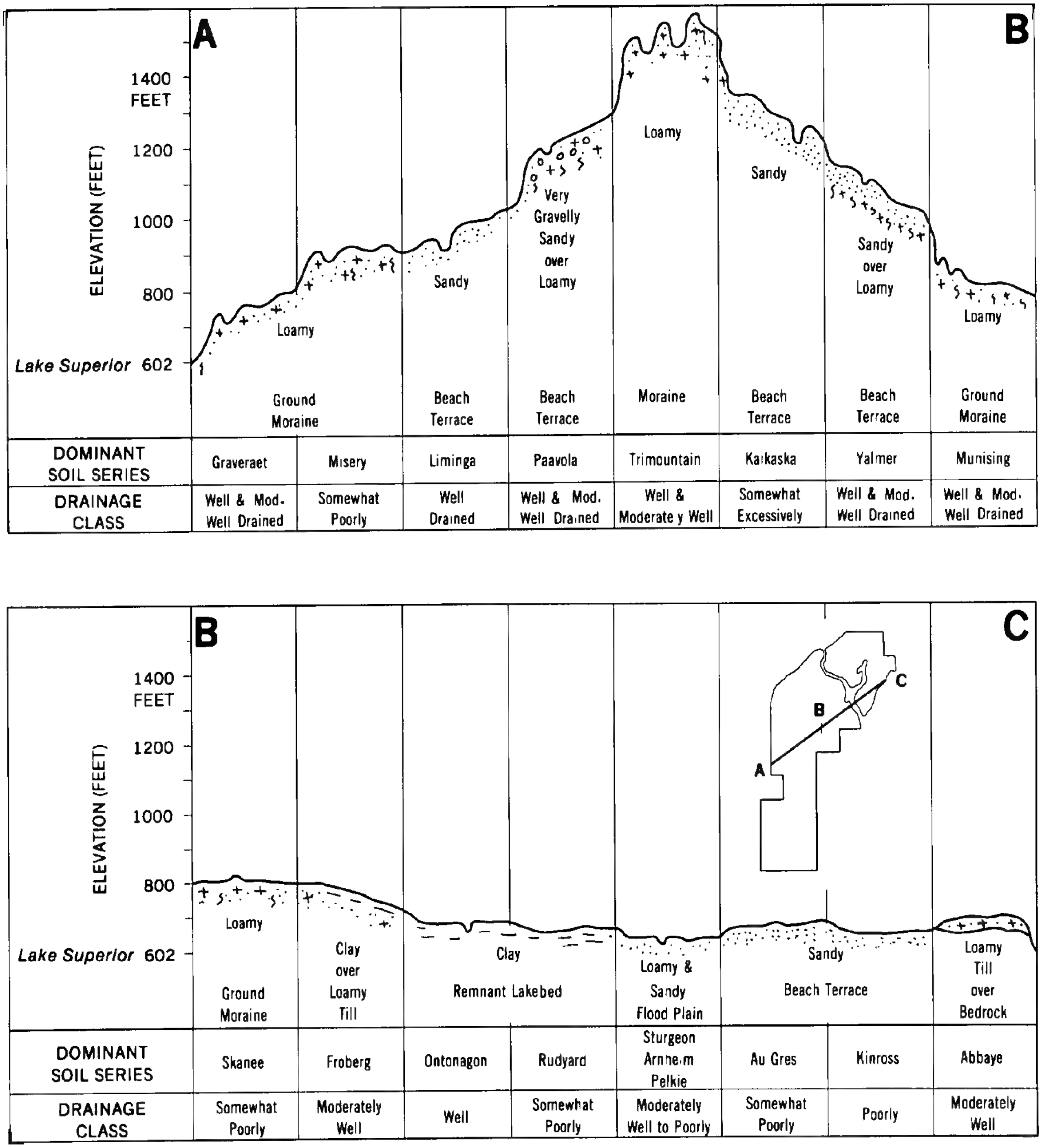

Figure 4.—Diagrammatic cross section of Houghton County showing the topography, elevation, general soil texture, landforms, and dominant soils and their drainage class.

lacustrine clay and limestone. Much of the area along the Copper Range, especially the area north of Houghton, consists of thin drift and bedrock ridges. To the west of the Copper Range is a ground moraine underlain by the Freda sandstone. The area has been strongly influenced by Glacial Lake Duluth. The glacial

till tends to be clay-rich and calcareous, especially in the area near Ontonagon County. The north part of this moraine appears to be water-laid. This segment may have been laid down under the ice margin while the waters of Lake Duluth were ponded against the ice. Here the till contains beds of lacustrine sand and poorly sorted gravel. These deposits grade into the end moraine system to the south and east.

A major end moraine system covers the Copper Range highland in central Houghton County and curves eastward in the southern part of the county, roughly following the outline of Keweenaw Bay. The drift along the terminal extent of the Keweenaw Bay Lobe is quite variable. Flow-till, melt-out till, and glaciofluvial deposits can coexist on the surface of ablation or dead-ice moraines and can become intermingled in a complex pattern when glacial ice melts.

Much of the glacial till on the Copper Range in central Houghton County tends to reflect the Portage Lake Lava Series with more brown and gray colors and cobbly textures. The drift is thin adjacent to the rocky ridges, but it ranges from 100 to 360 feet in the end moraine south of Painesdale. This moraine grades into the Sixmile moraine to the south. The till becomes redder and more calcareous because of the influence of the Jacobsville sandstone, Black River limestone, and lacustrine deposits. The Sixmile moraine grades into the Watton moraine to the south. The red tills in the Watton moraine are more clayey and have also been influenced by lacustrine deposits and limestone. Slate fragments are in the till to the south where the Watton moraine grades into the Winegar moraine.

The Winegar moraine is a ground, terminal, and recessional moraine complex of which only a small part is in Houghton County. The tills are quite variable, but they tend to reflect the underlying Michigamme slate, especially in the area to the east. The western part of this moraine was deposited by the Ontonagon Lobe.

Eskers, kame terraces, kames, and kettles are ice-contact features that occur throughout the area of ablation along the end moraine system. These deposits often grade into proglacial outwash. An example of pitted outwash occurs around Toivola Lakes. Stratified drift and outwash can be found in gaps in the Copper Range. The area around Portage and Torch Lakes has good examples of kame terraces and outwash-filled gaps. Eskers occur near the gaps at Allouez and Copper City.

The best developed outwash in Houghton County occurs in a broad, high delta plain near Sidnaw. The other areas of outwash in the county are relatively thin or have been washed over or reworked. Beach deposits and dune areas formed by slightly higher levels of Glacial Lake Nipissing can be found near Traverse Bay and F.J. McLain State Park. Two large areas of silty and clayey glacial lake-plain sediments are found near Tapiola and Alston. Extensive areas of sandy, loamy, and silty sediments occur on highly dissected lake plains on both sides of the Copper Range. Extensive deposits of stratified alluvium and organic deposits are in the valley of the Sturgeon River south of Chassell.

Lakes and Streams

Houghton County has 139 inland lakes with a surface area of about 20,899 acres. The three largest lakes are Otter, Portage, and Prickett Lakes. The soil conditions in the survey area are conducive to the construction of ponds, and over 350 have been constructed. The county also has 50 miles of Lake Superior shoreline.

The major rivers are the Sturgeon, Otter, Trap Rock, Salmon-Trout, Pilgrim, Graveraet, Elm, Misery, Silver, Jumbo, and Ontonagon Rivers. These rivers are all within the Lake Superior watershed. The many tributary streams offer some of the best trout fishing in the area.

Farming

The history of farming in Houghton County is directly related to the past mining industry. The first farms were located near the mining communities, which supplied the markets for their products. These early farms consisted of small dairy herds, and the principal crops were hay, oats, potatoes, and smaller amounts of fruits and vegetables. Most of the farm products were sold through cooperatives or directly to consumers and retail outlets.

The number of farms increased rapidly as the mining industry grew. In 1934, 2,000 farms were in the county. As the mining industry declined, however, the total number of farms also decreased. Presently the county has only about 195 farms.

Approximately 18,722 acres, or 3 percent of the land area in Houghton County, is used for the production of agricultural products. Of this acreage, about 10,000 acres is classified as cropland and the remainder is used either as permanent pasture or for specialty crops.

The predominant form of agriculture in Houghton County is dairy farming, although there are some small livestock operations. The county also has numerous strawberry and raspberry growers. Only a few potato farms remain.

Munising, Ontonagon, and Trimountain are the soils most commonly farmed in the county.

Industry and Transportation Facilities

Retail trade and the service industry are the major employers in Houghton County. Together they employ about 62 percent of the workforce. The county also has about 50 manufacturing establishments. Lumber and wood products are the major items produced.

The main roads in the county are U.S. Highway 41 and State Highways M-26, M-28, and M-38. The county is served by one railroad, which passes through the southern part of the county. An airport provides regularly scheduled passenger service.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads,

and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

Survey Procedures

The general procedures followed in making this survey are described in the National Soils Handbook and the Soil Survey Manual *(15)* of the Soil Conservation Service.

Before traversing the landscape, the soil scientists compared each map sheet to the U.S.G.S. topographic map for the area and stereoscopically plotted preliminary boundaries of slopes and landforms on aerial photographs. Some traverses were made by truck or trail bike on the existing network of roads or trails, but most were made on foot. Most traverses were made at intervals of about ¼ mile. Traverses or random observations were made at closer intervals in areas of high variability.

Soil examinations along the traverses were made every ⅛ mile or wherever obvious soil boundaries were crossed. Observations of such items as landforms, blown down trees, vegetation, roadbanks, and rock outcrops were made continuously without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. The soil material was examined with the aid of a hand auger or a spade to a depth of about 5 feet. The pedons described as typical were observed and studied in pits.

Samples for chemical and physical analyses were taken from the sites of the typical pedon for some of the major soils in the survey area. The analyses were made by the National Soil Survey Laboratory in Lincoln, Nebraska, and by the Michigan Technological University Soil Laboratory in Houghton, Michigan. The results of the analyses are stored in a computerized data file at the laboratories. The results of the analyses and descriptions of the laboratory procedures can be obtained by request.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Boundaries for the general soil map associations have been extended across the Ottawa National Forest to the southern Houghton County line. However, only private land within the national forest has been mapped in detail.

Soil Descriptions

Nearly Level to Steep, Very Deep, Somewhat Excessively Drained to Somewhat Poorly Drained Soils

These soils generally are suitable as woodland. The equipment limitation is the major concern in managing woodland. Some of the soils are suitable as cropland. If cultivated crops are grown, water erosion is a hazard.

1. Munising-Yalmer Association

Very deep, nearly level to rolling, moderately well drained, sandy soils on till plains and moraines

This association is on broad flats, low knolls, and side slopes. Slopes are generally convex and are smooth or irregular. They are dissected by drainageways in some areas. They range from 1 to 15 percent.

This association makes up about 10 percent of the survey area. It is about 55 percent Munising and similar soils, 30 percent Yalmer and similar soils, and 15 percent soils of minor extent (fig. 5).

Typically, the Munising soils have a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, very firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam.

Typically, the Yalmer soils have about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray sand about 9 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is dark reddish brown, reddish brown, and yellowish red, very friable sand; light reddish brown and reddish brown, very firm loamy sand; reddish brown and light reddish brown, mottled, very firm, mixed fine sandy loam and loamy sand; and reddish brown, mottled, very firm fine sandy loam. The substratum to a depth of about 60 inches is reddish brown fine sandy loam.

Minor in this association are the somewhat poorly drained Skanee and Assinins and poorly drained Gay soils in depressions and drainageways.

Most areas of this association are wooded. The major soils are well suited to woodland. The main concerns in managing woodland are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition.

The major soils are well suited or fairly well suited to cultivated crops, hay, and pasture. Seasonal wetness and the erosion hazard are the major management concerns.

2. Trimountain-Paavola-Net Association

Very deep, nearly level to steep, well drained to

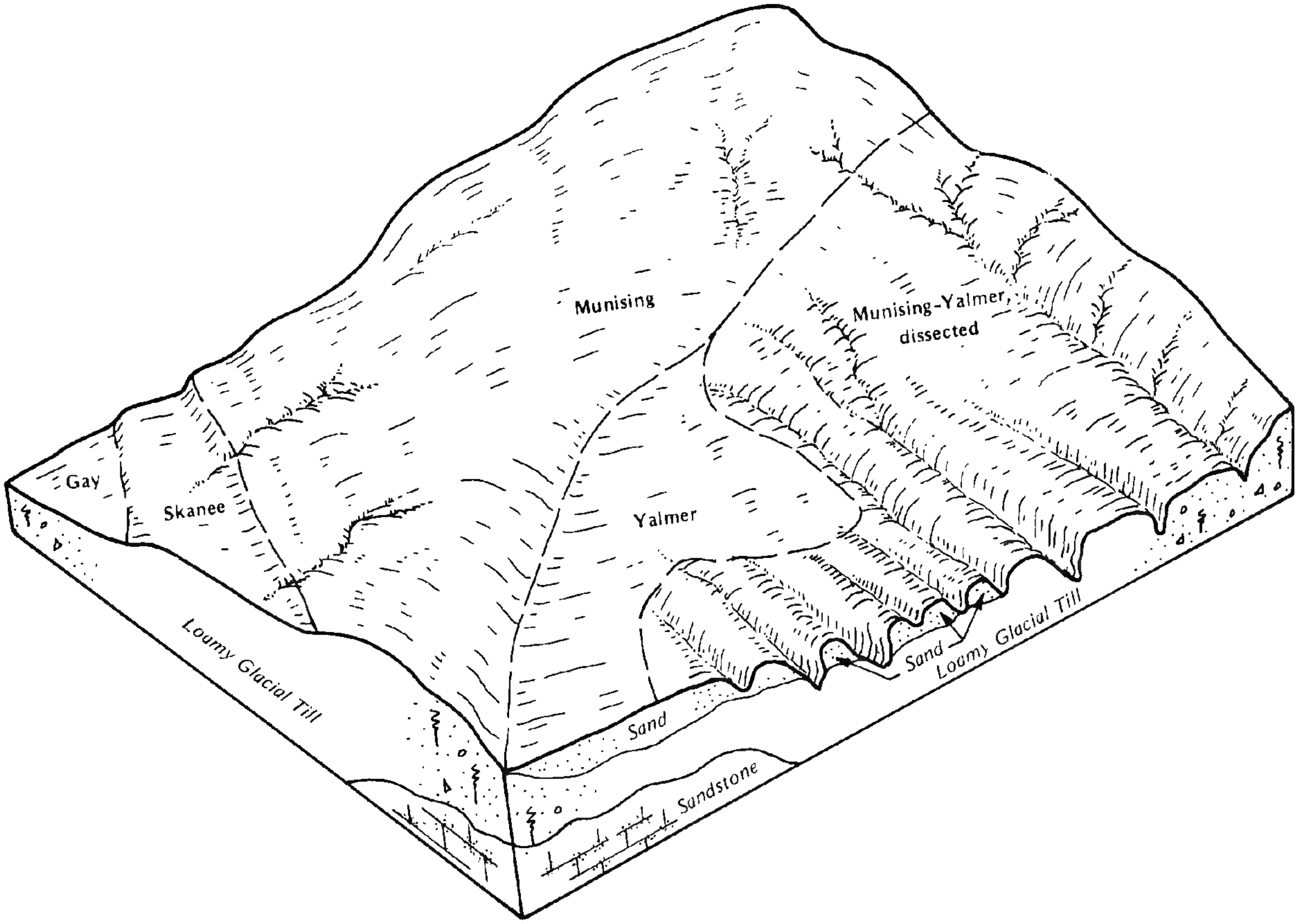

Figure 5.—Typical pattern of soils and parent material in the Munising-Yalmer association.

somewhat poorly drained, loamy soils on till plains and moraines

This association is on broad flats, knolls, and ridges and in depressions and drainageways. Slopes are convex or concave and are smooth or irregular. They are dissected by drainageways in some areas. They range from 0 to 35 percent.

This association makes up about 3 percent of the survey area. It is about 42 percent Trimountain and similar soils, 25 percent Paavola and similar soils, 15 percent Net and similar soils, and 18 percent soils of minor extent (fig. 6).

The Trimountain soils are nearly level to steep and are moderately well drained or well drained. Typically, they have about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, mottled, very firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, mottled, very firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

The Paavola soils are moderately deep to dense till, are nearly level to steep, and are moderately well drained or well drained. Typically, about 2 inches of undecomposed forest litter is on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable, extremely gravelly coarse sand; mixed dark reddish gray and reddish brown,

mottled, very firm gravelly loamy fine sand and gravelly fine sandy loam; and reddish brown, mottled, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

The Net soils are nearly level and somewhat poorly drained. Typically, the surface layer is very dark brown stony fine sandy loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is dark reddish brown, friable fine sandy loam; the next part is reddish brown and dark reddish brown, mottled, very firm fine sandy loam and gravelly fine sandy loam; and the lower part is reddish brown, mottled, friable gravelly loamy sand. The substratum to a depth of about 60 inches is reddish brown, mottled, gravelly loamy sand.

Minor in this association are the excessively drained Waiska and well drained Liminga soils on old lake plains and beaches and the poorly drained Witbeck soils in depressions and drainageways.

Most areas of this association support northern hardwoods. The major soils are fairly well suited to woodland. The main concerns in managing woodland are the equipment limitation, the windthrow hazard, and plant competition. Seedling mortality is a management concern on the Paavola and Net soils, and erosion is a hazard in the steep areas of the Trimountain and Paavola soils.

About 20 percent of this association has been cleared. Most of the cleared areas are used for hay or pasture or are idle. They commonly are reverting to brush. The Trimountain and Paavola soils are fairly well suited to cultivated crops, hay, and pasture. If cultivated crops are grown, controlling water erosion, reducing wetness, and maintaining the organic matter content and tilth are the major management concerns. A seasonal high water table, a low available water capacity, and surface compaction are the major concerns in managing pasture or hayland.

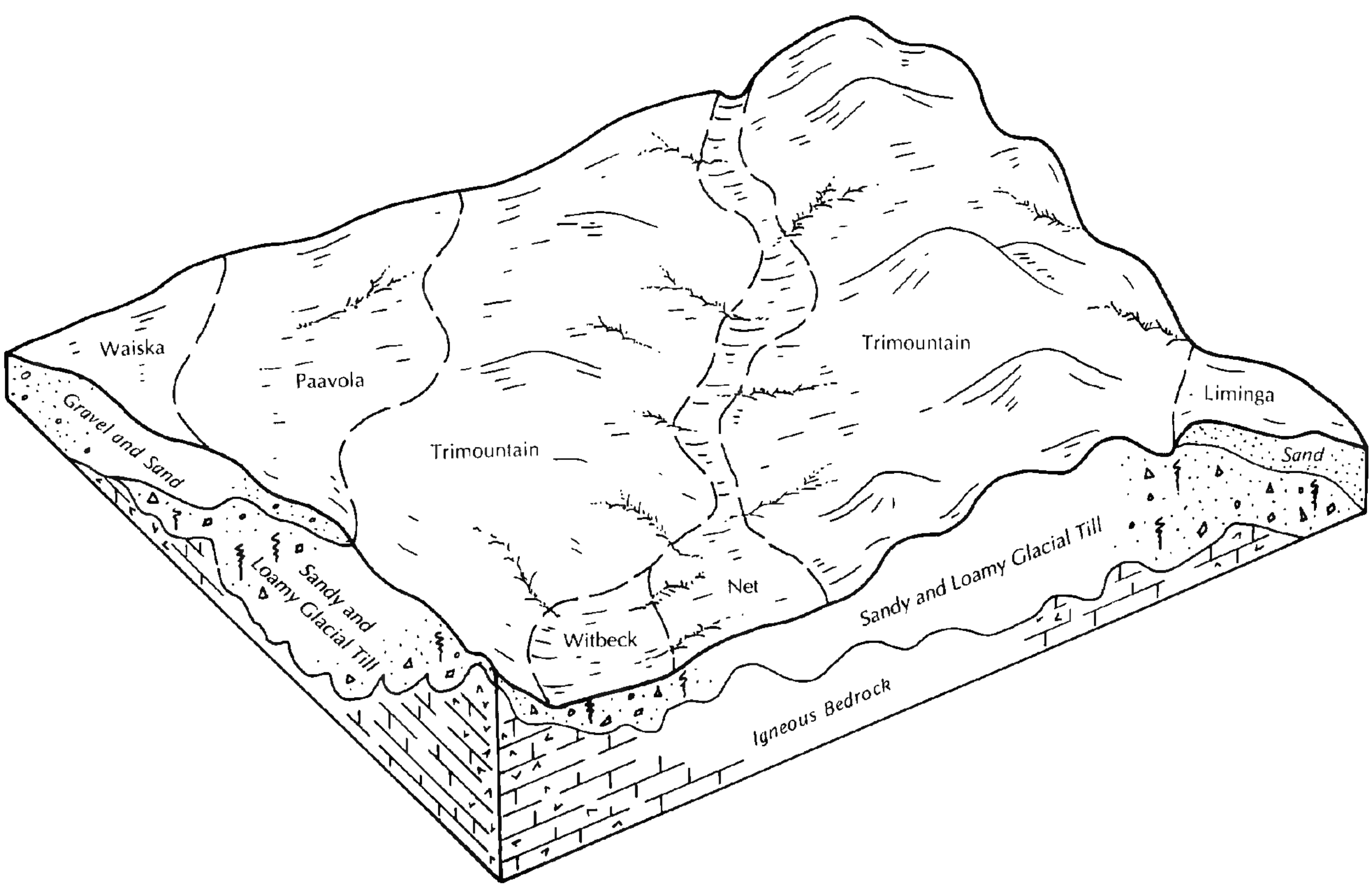

Figure 6.—Typical pattern of soils and parent material in the Trimountain-Paavola-Net association.

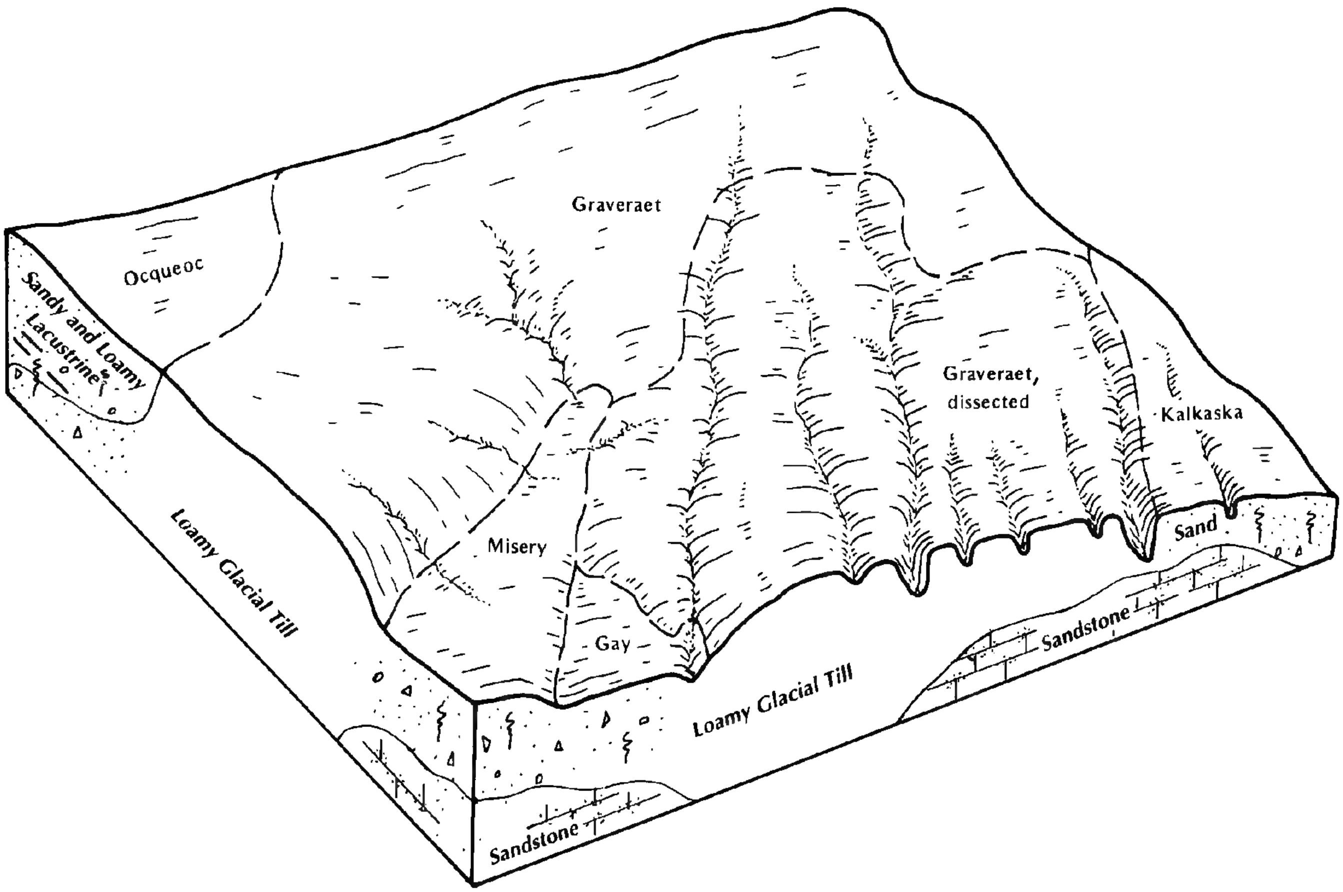

Figure 7.—Typical pattern of soils and parent material in the Graveraet-Misery-Ocqueoc association.

3. Graveraet-Misery-Ocqueoc Association

Very deep, nearly level to steep, well drained to somewhat poorly drained, loamy and sandy soils on till plains, moraines, and lake plains

This association is on broad flats, knolls, ridges, and side slopes and in depressions and drainageways. Slopes are convex or concave and are smooth or irregular. They are dissected by drainageways in some areas. They range from 0 to 35 percent.

This association makes up about 15 percent of the survey area. It is about 50 percent Graveraet and similar soils, 20 percent Misery and similar soils, 15 percent Ocqueoc and similar soils, and 15 percent soils of minor extent (fig. 7).

The Graveraet soils are nearly level to steep and are moderately well drained or well drained. Typically, the surface layer is black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, mottled, very firm fine sandy loam and reddish brown, mottled, very firm loam. The substratum to a depth of about 60 inches is reddish brown loam.

The Misery soils are nearly level and somewhat poorly drained. Typically, the surface layer is black very fine sandy loam about 4 inches thick. The subsurface layer is dark reddish gray, mottled very fine sandy loam about 3 inches thick. The subsoil is about 31 inches thick. The upper part is reddish brown, mottled, friable very fine sandy loam; the next part is reddish brown, firm loam mixed with light brown, mottled, firm fine sandy loam; and the lower part is reddish brown, very firm loam. The substratum to a depth of about 60 inches is reddish brown loam.

The Ocqueoc soils are nearly level and gently sloping and are moderately well drained. Typically, they have about 1 inch of black, partially decomposed forest

litter on the surface. The surface layer is reddish brown fine sand about 4 inches thick. The subsoil is very friable fine sand about 24 inches thick. The upper part is dark reddish brown and dark brown, and the lower part is brown and mottled. The substratum is stratified reddish brown and brown, mottled very fine sandy loam, loamy fine sand, and loamy very fine sand.

Minor in this association are the Alcona, Kalkaska, Liminga, and Gay soils. Alcona soils are moderately well drained or well drained, and Liminga soils are well drained. They are on lake plains. Kalkaska soils are somewhat excessively drained and are on beach ridges and knolls. Gay soils are poorly drained and are in depressions and drainageways.

Most areas of this association are wooded. The major soils are well suited or fairly well suited to woodland. The main management concerns are the equipment limitation and plant competition. Windthrow is a hazard on the Graveraet and Misery soils, and seedling mortality is a management concern on the Misery and Ocqueoc soils. Erosion is a hazard in the steep areas of the Graveraet soils.

The major soils are well suited or fairly well suited to cultivated crops, hay, and pasture. If cultivated crops are grown, controlling water erosion, reducing wetness, and maintaining the organic matter content and tilth are the major management concerns. A seasonal high water table, a low available water capacity, and surface compaction are the major concerns in managing pasture or hayland.

4. Rudyard-Froberg-Ontonagon Association

Very deep, nearly level to steep, well drained to somewhat poorly drained, silty soils on lake plains

This association is on broad flats, on low knolls, and in depressions and drainageways. Slopes are generally smooth and are convex or concave. They range from 0 to 35 percent.

This association makes up about 4 percent of the survey area. It is about 35 percent Rudyard and similar soils, 32 percent Froberg and similar soils, 17 percent Ontonagon and similar soils, and 16 percent soils of minor extent.

The Rudyard soils are nearly level and somewhat poorly drained. Typically, the surface layer is dark reddish brown silt loam about 4 inches thick. The subsurface layer is reddish gray, mottled silt loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is dark reddish brown, mottled, firm clay, and the lower part is reddish brown, mottled, very firm clay. The substratum to a depth of about 60 inches is reddish brown clay.

The Froberg soils are nearly level and gently sloping and are moderately well drained. Typically, the surface layer is reddish brown silt loam about 6 inches thick. The subsoil is about 26 inches thick. The upper part is reddish brown, firm silty clay and silty clay loam; the next part is reddish brown, very firm silty clay; and the lower part is reddish brown, mottled, very firm silty clay. The substratum to a depth of about 60 inches is reddish brown sandy loam.

The Ontonagon soils are nearly level to steep and are well drained. Typically, the surface layer is dark reddish brown silt loam about 7 inches thick. The subsoil is about 17 inches thick. The upper part is reddish brown, firm clay mixed with reddish gray silty clay loam, and the lower part is reddish brown, very firm clay. The substratum to a depth of about 60 inches is reddish brown clay.

Minor in this association are the moderately well drained Manistee and Munising soils on broad flats and low knolls and the poorly drained Bergland soils in depressions and drainageways.

Most areas of this association are used as hayland, pasture, woodland, or cropland. The major soils are well suited to hay and pasture. They are fairly well suited to woodland and cultivated crops. The major concerns in managing woodland are the equipment limitation, the windthrow hazard, and plant competition. The erosion hazard is a management concern in the steep areas of the Ontonagon soil, and seedling mortality is a management concern on the Rudyard soils. The main concerns in managing cultivated areas are reducing wetness and maintaining the organic matter content and tilth. The main concern in managing pasture or hayland is preventing surface compaction.

5. Keweenaw-Trimountain-Kalkaska Association

Very deep, nearly level to steep, moderately well drained to somewhat excessively drained, loamy and sandy soils on water-worked till plains and moraines

This association is on broad flats, low knolls, ridges, and side slopes. Slopes are generally convex and are smooth or irregular. They are dissected by drainageways in some areas. They range from 1 to 35 percent.

This association makes up about 2 percent of the survey area. It is about 25 percent Keweenaw and similar soils, 25 percent Trimountain and similar soils, 20 percent Kalkaska and similar soils, and 30 percent soils of minor extent.

The Keweenaw soils are well drained. Typically, the surface layer is black gravelly loamy sand about 2 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, very friable gravelly loamy sand; the next part is dark reddish brown and reddish brown, friable and very friable gravelly loamy sand; and the lower part is reddish brown, firm fine sandy loam and light reddish brown loamy fine sand. The substratum to a depth of about 60 inches is reddish brown loamy sand.

The Trimountain soils are moderately well drained. Typically, about 1 inch of black, decomposed forest litter is on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, mottled, very firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, mottled, very firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

The Kalkaska soils are somewhat excessively drained. Typically, they have about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand.

Minor in this association are the Halfaday, Net, Roscommon, and Waiska soils. Halfaday and Waiska soils are in scattered areas throughout the association. Halfaday soils are moderately well drained, and Waiska soils are excessively drained. Net and Roscommon soils are in depressions and drainageways. Net soils are somewhat poorly drained, and Roscommon soils are poorly drained.

Most areas of this association are wooded. The major soils are well suited or fairly well suited to woodland. The main management concerns are the equipment limitation and plant competition. The windthrow hazard is a concern on the Trimountain soils. The erosion hazard is a concern in the steep areas, and seedling mortality is a concern on the Keweenaw and Kalkaska soils.

About 20 percent of this association has been cleared. Most of the cleared areas are used for hay or pasture or are idle. The major soils are well suited or fairly well suited to hay, pasture, and small grain. If cultivated crops are grown, controlling water erosion and wind erosion, reducing droughtiness, and maintaining the organic matter content and tilth are the major management concerns. A low available water capacity is the major concern in managing pasture or hayland.

6. Champion-Karlin-Kallio Association

Very deep, nearly level to steep, moderately well drained to somewhat excessively drained, loamy soils on till plains and moraines

This association is on broad plains, knolls, hills, and ridges. Slopes are generally convex and are smooth or irregular. They range from 1 to 35 percent.

This association makes up about 3 percent of the survey area. It is about 40 percent Champion and similar soils, 25 percent Karlin and similar soils, 15 percent Kallio and similar soils, and 20 percent soils of minor extent.

The Champion soils are nearly level to steep and are well drained or moderately well drained. Typically, they have about 1 inch of black, partially decomposed forest litter on the surface. The subsurface layer is reddish gray cobbly very fine sandy loam about 4 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, friable cobbly very fine sandy loam and cobbly fine sandy loam; the next part is reddish brown, mottled, very firm gravelly fine sandy loam; and the lower part is mixed brown and reddish brown, mottled, very firm gravelly loamy fine sand. The substratum to a depth of about 60 inches is brown gravelly loamy sand.

The Karlin soils are nearly level to steep and are somewhat excessively drained. Typically, they have about 1 inch of black, well decomposed forest litter on the surface. The surface layer is dark gray fine sandy loam about 3 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown and brown, friable fine sandy loam, and the lower part is brown, loose sand. The substratum to a depth of about 60 inches is strong brown sand.

The Kallio soils are nearly level to rolling and are moderately well drained. Typically, the surface layer is black cobbly very fine sandy loam about 3 inches thick. The subsurface layer is reddish gray cobbly very fine sandy loam about 2 inches thick. The subsoil is about 31 inches thick. In sequence downward, it is dark reddish brown, friable very fine sandy loam; reddish brown, mottled, friable very fine sandy loam; reddish brown, mottled, very firm, mixed very fine sandy loam and loam; and reddish brown, very firm, mixed loam

and very fine sandy loam. The substratum to a depth of about 60 inches is reddish brown loam.

Minor in this association are the Alcona, Alstad, Fence, Michigamme, Net, and Witbeck soils. Alcona and Fence soils are well drained or moderately well drained. They are on small lake plains. Alstad, Net, and Witbeck soils are in depressions and drainageways. Alstad and Net soils are somewhat poorly drained, and Witbeck soils are poorly drained. Michigamme soils are well drained or moderately well drained and are moderately deep. They are on rocky hills and ridges underlain by bedrock.

Most areas of this association are wooded. The Karlin soils are well suited to woodland, and the Champion and Kallio soils are fairly well suited. The major management concerns are the equipment limitation and the windthrow hazard on the Champion and Kallio soils and plant competition on the Champion, Karlin, and Kallio soils. The erosion hazard is a concern in the steep areas of the Champion and Karlin soils.

7. Alstad-Kallio-Watton Association

Very deep, nearly level and gently sloping, well drained to somewhat poorly drained, loamy soils on till plains and moraines

This association is on broad flats, side slopes, knolls, and low ridges and in depressions and drainageways. Slopes range from 0 to 8 percent.

This association makes up about 1 percent of the survey area. It is about 33 percent Alstad and similar soils, 33 percent Kallio and similar soils, 25 percent Watton and similar soils, and 9 percent soils of minor extent.

The Alstad soils are nearly level and somewhat poorly drained. Typically, the surface layer is dark reddish brown loam about 5 inches thick. The subsurface layer is reddish brown, mottled loam about 2 inches thick. The subsoil is about 22 inches thick. The upper part is reddish brown, mottled, firm, mixed clay loam and loam; the next part is reddish brown, mottled, firm clay loam; and the lower part is reddish brown, firm clay loam. The substratum to a depth of about 60 inches is reddish brown loam.

The Kallio soils are nearly level and gently sloping and are moderately well drained. Typically, the surface layer is black cobbly very fine sandy loam about 3 inches thick. The subsurface layer is reddish gray cobbly very fine sandy loam about 2 inches thick. The subsoil is about 31 inches thick. In sequence downward, it is dark reddish brown, friable very fine sandy loam; reddish brown, mottled, friable very fine sandy loam; reddish brown, mottled, very firm, mixed very fine sandy loam and loam; and reddish brown, very firm, mixed loam and very fine sandy loam. The substratum to a depth of about 60 inches is reddish brown loam.

The Watton soils are nearly level and gently sloping and are well drained. Typically, the Watton soil has a surface layer of reddish brown loam about 7 inches thick. The subsoil is about 29 inches thick. The upper part is reddish brown, firm, mixed clay loam and loam, and the lower part is reddish brown, firm clay loam. The substratum to a depth of about 60 inches is reddish brown clay loam.

Minor in this association are the moderately well drained Alcona and Ocqueoc soils on small lake plains; poorly drained, loamy soils in depressions and drainageways; and the very poorly drained Lupton and Loxley soils in swamps and bogs.

Most areas of this association support northern hardwoods. The major soils are fairly well suited to woodland. The main management concerns are the equipment limitation and plant competition. Windthrow is a hazard on the Alstad and Kallio soils, and seedling mortality is a concern on the Alstad soils.

About 20 percent of this association has been cleared. Most of the cleared areas are used for hay or pasture or are idle. The Watton soils are fairly well suited to hay, pasture, and small grain. If cultivated crops are grown, controlling water erosion, reducing wetness, and maintaining the organic matter content and tilth are the major management concerns. Preventing surface compaction is the major concern in managing pasture or hayland.

Nearly Level And Undulating, Very Deep, Moderately Well Drained to Very Poorly Drained Soils

These soils generally are suitable as woodland. The equipment limitation and the windthrow hazard are the major concerns in managing woodland. Most of the soils are poorly suited to cultivated crops because of occasional flooding and wetness.

8. Sturgeon-Arnheim-Pelkie Association

Very deep, nearly level, poorly drained to moderately well drained, silty and sandy soils on flood plains

This association is on bottom land along rivers and streams. It is subject to flooding. Slopes range from 0 to 3 percent.

This association makes up about 1 percent of the survey area. It is about 40 percent Sturgeon and similar soils, 30 percent Arnheim and similar soils, 15 percent

Pelkie and similar soils, and 15 percent soils of minor extent.

The Sturgeon soils are somewhat poorly drained. Typically, they have a surface layer of reddish brown silt loam about 8 inches thick. The upper part of the substratum is reddish brown, mottled very fine sandy loam and silt loam; the next part is reddish brown, mottled loamy very fine sand; and the lower part to a depth of about 60 inches is dark reddish gray fine sand.

The Arnheim soils are poorly drained. Typically, they have a surface layer of reddish brown silt loam about 4 inches thick. The upper part of the substratum is dark reddish gray, mottled silt loam. The next part is reddish brown, mottled silt loam. The lower part to a depth of about 60 inches is brown and dark brown, stratified loamy fine sand, very fine sandy loam, and fine sand.

The Pelkie soils are moderately well drained. Typically, they have a surface layer of reddish brown fine sand about 7 inches thick. The substratum to a depth of about 60 inches is reddish brown loamy fine sand and light reddish brown, mottled fine sand.

Minor in this association are the very poorly drained Lupton and Cathro soils in old oxbows and depressions and the well drained Alcona and Liminga soils at the higher elevations.

Most areas of this association are used as woodland, hayland, pasture, or cropland. The Arnheim soils are poorly suited to these uses. The Sturgeon and Pelkie soils are well suited to woodland, hay, and pasture and are fairly well suited to cultivated crops. The main concerns in managing woodland are the equipment limitation, the windthrow hazard, and seedling mortality on the Arnheim and Sturgeon soils and plant competition on all the major soils. The main concerns in managing hayland, pasture, and cropland are occasional flooding and wetness.

9. Skanee-Munising-Gay Association

Very deep, nearly level and undulating, moderately well drained to poorly drained, loamy, sandy, and mucky soils on till plains

This association is on low knolls and broad flats and in drainageways and depressions. Slopes are convex or concave and are smooth or irregular. They range from 0 to 8 percent.

This association makes up about 8 percent of the survey area. It is about 38 percent Skanee and similar soils, 34 percent Munising and similar soils, 18 percent Gay and similar soils, and 10 percent soils of minor extent.

The Skanee soils are nearly level and somewhat poorly drained. Typically, they have about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray, mottled fine sandy loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is dark reddish brown, mottled, friable fine sandy loam; the next part is reddish brown, mottled, very firm fine sandy loam; and the lower part is reddish brown, friable sandy clay loam. The substratum to a depth of about 60 inches is reddish brown sandy loam.

The Munising soils are nearly level and undulating and are moderately well drained. Typically, they have a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, very firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam.

The Gay soils are nearly level and poorly drained. Typically, they have a surface layer of about 5 inches of black muck over about 3 inches of black mucky sandy loam. The subsoil is reddish brown, mottled, friable sandy loam about 16 inches thick. The substratum to a depth of about 60 inches is reddish brown sandy loam.

Minor in this association are the very poorly drained Lupton and Cathro soils in drainageways and depressions and the moderately well drained Yalmer and somewhat poorly drained Assinins soils in positions on the landscape similar to those of the Munising and Skanee soils. The Yalmer and Assinins soils are sandy in the upper part of the subsoil.

Most areas of this association are wooded. The major soils are fairly well suited to woodland. The main management concerns are the equipment limitation, the windthrow hazard, and plant competition on all the major soils. Seedling mortality is an additional concern on the Skanee and Gay soils.

10. Lupton-Loxley-Roscommon Association

Very deep, nearly level, very poorly drained and poorly drained, mucky and peaty soils on till plains, lake plains, outwash plains, and moraines

This association is in depressions, drainageways, swamps, and bogs. Slopes range from 0 to 2 percent.

This association makes up about 2 percent of the survey area. It is about 55 percent Lupton and similar

soils, 20 percent Loxley and similar soils, 15 percent Roscommon and similar soils, and 10 percent soils of minor extent.

The Lupton soils are very poorly drained. Typically, they are black muck to a depth of more than 60 inches.

The Loxley soils are very poorly drained. Typically, they have a surface layer of dark yellowish brown peat about 5 inches thick. The next 40 inches is black, very dark brown, and dark brown muck. Below this to a depth of about 60 inches is brown mucky peat.

The Roscommon soils are poorly drained. Typically, they have a surface layer of black muck and mucky sand about 6 inches thick. The substratum to a depth of about 60 inches is light brownish gray and pale brown sand.

Minor in this association are moderately well drained and well drained, gently sloping to steep mineral soils on knolls and ridges.

Most areas of this association are wooded. The Lupton and Loxley soils are poorly suited to woodland, and the Roscommon soils are fairly well suited. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition.

11. Halfaday-Au Gres-Roscommon Association

Very deep, nearly level, moderately well drained to poorly drained, sandy and mucky soils on outwash plains, lake plains, stream terraces, and till plains

This association is on broad flats, on low knolls, and in drainageways and depressions. Slopes range from 0 to 3 percent.

This association makes up about 6 percent of the survey area. It is about 30 percent Halfaday and similar soils, 30 percent Au Gres and similar soils, 20 percent Roscommon and similar soils, and 20 percent soils of minor extent.

The Halfaday soils are moderately well drained. Typically, they have about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is pinkish gray sand about 3 inches thick. The subsoil is dark reddish brown, yellowish red, and strong brown, friable sand about 27 inches thick. The substratum to a depth of about 60 inches is light brown and reddish brown, mottled sand.

The Au Gres soils are somewhat poorly drained. Typically, they have about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light brownish gray, mottled sand about 19 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish brown, loose sand about 20 inches thick. The substratum to a depth of about 60 inches is brown sand.

The Roscommon soils are poorly drained. Typically, they have a surface layer of black muck and mucky sand about 6 inches thick. The substratum to a depth of about 60 inches is light brownish gray and pale brown sand.

Minor in this association are the somewhat poorly drained Richter and well drained Alcona and Liminga soils. They are in scattered areas throughout the association. Richter and Alcona soils are finer textured than the major soils. Also included are areas of stamp sand along Torch and Portage Lakes.

Most areas of this association are wooded. The Halfaday and Au Gres soils are well suited to woodland, and the Roscommon soils are fairly well suited. The major management concerns are the equipment limitation, seedling mortality, and plant competition. The windthrow hazard is a concern on the Au Gres and Roscommon soils.

12. Kinross-Au Gres-Croswell Association

Very deep, nearly level, poorly drained to moderately well drained, mucky and sandy soils on beaches and lake plains

This association is on low ridges and in the intervening swales. Slopes range from 0 to 3 percent.

This association makes up about 1 percent of the survey area. It is about 30 percent Kinross and similar soils, 30 percent Au Gres and similar soils, 30 percent Croswell and similar soils, and 10 percent soils of minor extent.

The Kinross soils are poorly drained. Typically, they have a surface layer of black muck about 3 inches thick. The subsurface layer is pinkish gray sand about 6 inches thick. The subsoil is sand about 40 inches thick. The upper part is mottled brown and dark reddish brown and is very friable, and the lower part is reddish brown and loose. The substratum to a depth of about 60 inches is brown sand.

The Au Gres soils are somewhat poorly drained. Typically, they have about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light brownish gray, mottled sand about 19 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, loose sand about 20 inches thick. The substratum to a depth of about 60 inches is brown sand.

The Croswell soils are moderately well drained. Typically, they have a surface layer of very dark gray sand about 1 inch thick. The surface layer is light gray

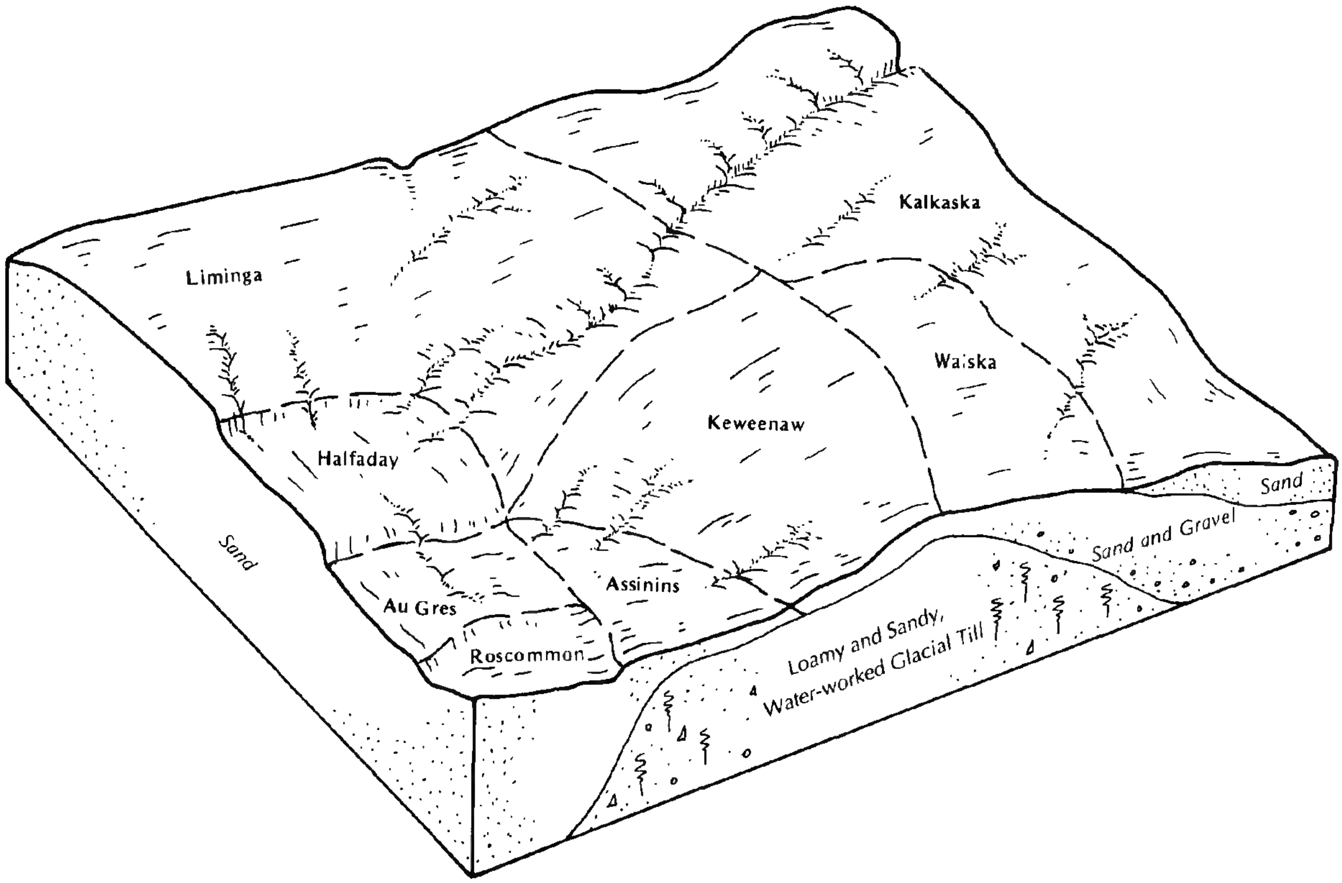

Figure 8.—Typical pattern of soils and parent material in the Kalkaska-Liminga-Waiska association.

and pinkish gray sand about 15 inches thick. The subsoil is brown and yellowish red, loose sand about 15 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is reddish yellow, mottled sand.

Minor in this association are the excessively drained Deer Park soils on beach ridges and dunes and the very poorly drained Dawson soils and areas of marsh in depressions and swales.

Most areas of this association are wooded. The Kinross and Croswell soils are fairly well suited to woodland, and the Au Gres soils are well suited. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition.

Nearly Level to Very Steep, Very Deep, Well Drained to Excessively Drained Soils

These soils generally are suitable as woodland. Seedling mortality and the equipment limitation are the major concerns in managing woodland.

13. Kalkaska-Liminga-Waiska Association

Very deep, nearly level to steep, well drained to excessively drained, sandy soils on outwash plains

This association is on broad flats, knolls, and ridges. Slopes are generally convex and are smooth or irregular. They are dissected by drainageways in some areas. They range from 0 to 35 percent.

This association makes up about 8 percent of the survey area. It is about 48 percent Kalkaska and similar soils, 20 percent Liminga and similar soils, 12 percent Waiska and similar soils, and 20 percent soils of minor extent (fig. 8).

The Kalkaska soils are somewhat excessively drained. Typically, they have about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick.

The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand.

The Liminga soils are well drained. Typically, they have about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand.

The Waiska soils are excessively drained. Typically, they have about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Minor in this association are the moderately well drained Keweenaw soils on moraines, the moderately well drained Halfaday soils on small flats, the somewhat poorly drained Assinins and Au Gres soils in drainageways, and the poorly or very poorly drained Roscommon soils in depressions.

Most areas of this association are wooded. The major soils are well suited to woodland. The main management concerns are the equipment limitation, seedling mortality, and plant competition. The erosion hazard is a management concern in the steep areas.

14. Vilas-Rubicon Association

Very deep, nearly level to steep, excessively drained, sandy soils on outwash plains, lake plains, and moraines

This association is on broad flats, ridges, and knolls. Slopes are long and plane or are short and convex. They range from 0 to 35 percent.

This association makes up about 6 percent of the survey area. It is about 48 percent Vilas and similar soils, 45 percent Rubicon and similar soils, and 7 percent soils of minor extent.

Typically, the Vilas soils have about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown loamy sand about 2 inches thick. The subsoil is about 33 inches thick. The upper part is dark brown and strong brown, very friable loamy sand, and the lower part is strong brown, very friable sand. The substratum to a depth of about 60 inches is brown sand.

Typically, the Rubicon soils have about 1 inch of black, well decomposed forest litter on the surface. The surface layer is brown sand about 4 inches thick. The subsoil is about 24 inches of dark brown and brown, very friable sand. The substratum to a depth of about 60 inches is light brown sand.

Minor in this association are the moderately well drained Croswell and somewhat poorly drained Au Gres soils in depressions and swales.

Most areas of this association are wooded. The major soils are fairly well suited to woodland. The main management concerns are the equipment limitation and seedling mortality. The erosion hazard is a concern in the steep areas.

15. Munising-Yalmer-Liminga Association

Very deep, nearly level to very steep, well drained, sandy soils on dissected till plains and moraines

This association is on dissected uplands. Ridgetops are moderately sloping to steep and are 20 to 200 feet wide. The ravines are parallel or dendritic, 8 to 70 feet deep, and 15 to 200 feet wide and have strongly sloping to very steep side slopes. The ravine bottoms are 5 to 40 feet wide. Some have seasonal streams. Slopes range from 1 to 70 percent.

This association makes up about 6 percent of the survey area. It is about 45 percent Munising and similar soils, 20 percent Yalmer and similar soils, 20 percent Liminga and similar soils, and 15 percent soils of minor extent.

Typically, the Munising soils have a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, very firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam.

Typically, the Yalmer soils have about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray sand about 9 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is dark reddish brown, reddish brown, and yellowish red, very friable sand; light reddish brown and reddish brown, firm loamy sand; reddish brown and light reddish brown, firm, mixed fine sandy loam and loamy sand; and reddish brown, very firm fine sandy loam.

The substratum to a depth of about 60 inches is reddish brown fine sandy loam.

Typically, the Liminga soils have about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand.

Minor in this association are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are the Alcona and Kalkaska soils in areas adjacent to the Liminga soils. In some areas the ravine bottoms have exposures of bedrock.

Most areas of this association are wooded. The major soils are well suited to woodland. The erosion hazard, the equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The erosion hazard is most severe on the steep or very steep sides of the ravines.

16. Kalkaska-Waiska Association

Very deep, moderately sloping to very steep, somewhat excessively drained and excessively drained, sandy soils on dissected outwash plains

This association is on dissected uplands. Ridgetops are moderately steep or steep and are 10 to 150 feet wide. The ravines are dendritic or parallel, 15 to 75 feet deep, and 40 to 250 feet wide and have moderately steep to very steep side slopes. The ravine bottoms are 8 to 60 feet wide. Some have seasonal streams. Slopes range from 8 to 70 percent.

This association makes up about 2 percent of the survey area. It is about 65 percent Kalkaska and similar soils, 20 percent Waiska and similar soils, and 15 percent soils of minor extent.

The Kalkaska soils are somewhat excessively drained. Typically, they have about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand.

The Waiska soils are excessively drained. Typically, they have about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Minor in this association are the well drained Alcona, Liminga, and Fence soils and somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Alcona and Fence soils are finer textured than the major soils. They are in areas adjacent to the Kalkaska soils. Liminga soils are fine sand. They are also in areas adjacent to the Kalkaska soils.

Most areas of this association are wooded. The major soils are well suited to woodland. The main management concerns are the equipment limitation, the erosion hazard, seedling mortality, and plant competition. The erosion hazard is most severe on the steep or very steep sides of the ravines.

17. Graveraet-Kalkaska Association

Very deep, moderately steep to very steep, well drained and somewhat excessively drained, loamy and sandy soils on dissected, water-worked till plains and moraines

This association is on dissected uplands. Ridgetops are moderately steep or steep and are 10 to 100 feet wide. The ravines are parallel or dendritic, 15 to 250 feet deep, and 40 to 600 feet wide and have moderately steep to very steep side slopes. The ravine bottoms are 10 to 150 feet wide. Some have seasonal streams. Slopes range from 15 to 70 percent.

This association makes up about 7 percent of the survey area. It is about 55 percent Graveraet and similar soils, 25 percent Kalkaska and similar soils, and 20 percent soils of minor extent.

The Graveraet soils are well drained. Typically, they have a surface layer of black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, mottled, very firm fine sandy loam and reddish brown, mottled, very firm loam. The substratum to a depth of about 60 inches is reddish brown loam.

The Kalkaska soils are somewhat excessively drained. Typically, they have about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand.

Minor in this association are the well drained Alcona

and Fence soils and somewhat poorly drained and poorly drained, loamy and sandy soils on the ravine bottoms. Alcona and Fence soils are in scattered areas throughout the association. In some areas the ravine bottoms have exposures of bedrock.

Most areas of this association are wooded. The major soils are well suited to woodland. The erosion hazard, the equipment limitation, the windthrow hazard, and plant competition are management concerns. The hazard of erosion is most severe on the steep or very steep sides of the ravines. Seedling mortality is a concern on the Kalkaska soils.

18. Nunica-Fence-Alcona Association

Very deep, nearly level to very steep, well drained and moderately well drained, silty, loamy, and sandy soils on dissected lake plains

This association is on dissected uplands. Ridgetops are moderately sloping to steep and are 15 to 200 feet wide. The ravines are dominantly parallel, 10 to 50 feet deep, and 20 to 150 feet wide and have moderately steep to very steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Slopes range from 1 to 60 percent.

This association makes up about 2 percent of the survey area. It is about 40 percent Nunica and similar soils, 30 percent Fence and similar soils, 20 percent Alcona and similar soils, and 10 percent soils of minor extent.

The Nunica soils are well drained. Typically, they have a surface layer of reddish brown silt loam about 3 inches thick. The next layer is brown, firm silt loam mixed with reddish brown silty clay loam. The subsoil is about 12 inches thick. It is firm, reddish brown silty clay loam mixed with reddish gray silt loam. The substratum to a depth of about 60 inches is red and reddish brown, stratified silt loam and silty clay loam.

The Fence soils are well drained or moderately well drained. Typically, they have about 2 inches of black, partially decomposed forest litter on the surface. The surface layer is reddish brown very fine sandy loam about 2 inches thick. The subsoil is friable very fine sandy loam about 40 inches thick. The upper part is reddish brown and brown, and the lower part is reddish brown. The substratum to a depth of about 60 inches is reddish brown silt loam and very fine sandy loam.

The Alcona soils are well drained or moderately well drained. Typically, they have a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Minor in this association are the well drained Liminga soils and somewhat poorly drained and poorly drained, silty and loamy soils on the ravine bottoms. Liminga soils are sandy and are in areas adjacent to the Alcona soils.

Most areas of this association are wooded. The major soils are well suited to woodland. The main management concerns are the erosion hazard, the equipment limitation, and plant competition. The erosion hazard is most severe on the steep or very steep sides of the ravines.

Nearly Level to Very Steep, Very Deep, Moderately Deep, and Shallow, Somewhat Excessively Drained to Somewhat Poorly Drained Soils

These soils generally are suitable as woodland. The equipment limitation, the erosion hazard, and the windthrow hazard are the major concerns in managing woodland.

19. Munising-Abbaye-Kalkaska Association

Very deep and moderately deep, nearly level to very steep, well drained and somewhat excessively drained, sandy soils on dissected till plains and moraines

This association is on dissected uplands. Ridgetops are moderately sloping to steep and are 10 to 150 feet wide. The parallel ravines are 10 to 120 feet deep and 20 to 300 feet wide and have moderately steep to very steep side slopes. The ravine bottoms are 5 to 35 feet wide. Most have seasonal streams. Many areas of this association have sandstone ledges and waterfalls. Slopes range from 0 to 70 percent.

This association makes up about 2 percent of the survey area. It is about 40 percent Munising and similar soils, 25 percent Abbaye and similar soils, 20 percent Kalkaska and similar soils, and 15 percent soils of minor extent.

The Munising soils are very deep and well drained. Typically, they have a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, very firm sandy loam and loamy sand.

The substratum to a depth of about 60 inches is reddish brown sandy loam.

The Abbaye soils are moderately deep and well drained. Typically, they have a surface layer of very dark gray loamy fine sand about 1 inch thick. The subsurface layer is reddish gray loamy fine sand about 5 inches thick. The subsoil is about 24 inches thick. In sequence downward, it is reddish brown, very friable fine sandy loam; brown, friable fine sandy loam; yellowish red and pinkish gray, firm fine sandy loam; and reddish brown and pinkish gray, firm sandy loam and loamy sand. Sandstone bedrock is at a depth of about 32 inches.

The Kalkaska soils are deep and somewhat excessively drained. Typically, they have about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand.

Minor in this association are the well drained Alcona soils; somewhat poorly drained and poorly drained, loamy and sandy soils on the ravine bottoms; and areas of very shallow soils and rock outcrop. The rocky areas are on the sides and bottom of the ravines. The Alcona soils are adjacent to the Kalkaska soils.

Most areas of this association are wooded. The major soils are well suited to woodland. The main management concerns are the equipment limitation, the erosion hazard, and plant competition. The erosion hazard is most severe on the steep or very steep sides of the ravines. Seedling mortality is a concern on the Kalkaska soils.

20. Abbaye-Zeba-Munising Association

Very deep and moderately deep, nearly level and gently sloping, moderately well drained and somewhat poorly drained, sandy and loamy soils on sandstone benches and till plains

This association is on low knolls and broad flats and in drainageways and depressions. Slopes range from 0 to 8 percent.

This association makes up about 2 percent of the survey area. It is about 40 percent Abbaye and similar soils, 20 percent Zeba and similar soils, 20 percent Munising and similar soils, and 20 percent soils of minor extent.

The Abbaye soils are nearly level and gently sloping and are moderately deep and moderately well drained. Typically, they have a surface layer of very dark gray loamy fine sand about 1 inch thick. The subsurface layer is reddish gray loamy fine sand about 5 inches thick. The subsoil is about 24 inches thick. In sequence downward, it is reddish brown, very friable fine sandy loam; brown, friable fine sandy loam; yellowish red and pinkish gray, firm fine sandy loam; and reddish brown and pinkish gray, mottled, firm sandy loam and loamy sand. Sandstone bedrock is at a depth of about 32 inches.

The Zeba soils are nearly level, moderately deep, and somewhat poorly drained. Typically, they have about 3 inches of black, well decomposed forest litter on the surface. The surface layer is gray fine sandy loam about 5 inches thick. The subsoil is about 30 inches thick. The upper part is reddish brown, friable fine sandy loam, and the lower part is reddish brown, mottled, firm fine sandy loam. Sandstone bedrock is at a depth of about 35 inches.

The Munising soils are nearly level and gently sloping and are deep and moderately well drained. Typically, they have a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, very firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam.

Minor in this association are the Assinins, Deerton, Freda, Jacobsville, and Skanee soils. The deep, somewhat poorly drained Assinins and Skanee soils are in landscape positions similar to those of the Zeba soils. The moderately deep, somewhat excessively drained Deerton and shallow, well drained Freda soils are in landscape positions similar to those of the Abbaye soils. Deerton soils have a sandy subsoil. The moderately deep, poorly drained Jacobsville soils are in depressions and drainageways.

Most areas of this association are wooded. The major soils are well suited or fairly well suited to woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns.

The Abbaye and Munising soils are fairly well suited to cropland. Controlling water erosion, reducing droughtiness, and maintaining the organic matter content are the major management concerns. The Abbaye and Munising soils are well suited to pasture

and hayland, and the Zeba soils are fairly well suited. Wetness and compaction are the major management concerns.

21. Trimountain-Paavola-Arcadian Association

Very deep and shallow, nearly level to very steep, well drained and moderately well drained, loamy soils on till plains and moraines

This association is on knolls, hills, and ridges. Shallow soils generally are in the steeper areas. Slopes are rugged and irregular. They are dissected by ravines and drainageways in some areas. They range from 1 to 60 percent.

This association makes up about 9 percent of the survey area. It is about 42 percent Trimountain and similar soils, 25 percent Paavola and similar soils, 8 percent Arcadian and similar soils, and 25 percent soils of minor extent.

The Trimountain soils are nearly level to very steep, are very deep, and are well drained and moderately well drained. Typically, they have about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, very firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, very firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

The Paavola soils are nearly level to very steep, are very deep, and are well drained or moderately well drained. Typically, they have about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; mixed dark reddish gray and reddish brown, very firm gravelly loamy fine sand and gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

The Arcadian soils are nearly level to rolling and are shallow and well drained. Typically, they have a surface layer of dark brown very cobbly fine sandy loam about 5 inches thick. The subsoil is about 13 inches thick. It is dark reddish brown, very friable very gravelly fine sandy loam. Bedrock is at a depth of about 18 inches. In places the depth to bedrock is less than 10 inches.

Minor in this association are the Allouez, Michigamme, Net, Waiska, and Witbeck soils. Allouez soils are well drained, and Waiska soils are excessively drained. They are gravelly soils on stream terraces, eskers, and old beaches. Michigamme soils are moderately deep and moderately well drained and are in areas adjacent to the Arcadian soils. Net soils are somewhat poorly drained, and Witbeck soils are poorly drained. They are in depressions and drainageways. Also included are areas of rock outcrop and piles or areas of waste rock from past copper mining activities.

Most areas of this association are wooded. The major soils are fairly well suited to woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. Seedling mortality is a concern on the Paavola soils. The erosion hazard is most severe on the steep or very steep sides of the ravines in dissected areas.

About 20 percent of this association has been cleared. Most of the cleared areas are used for hay or pasture or are idle. Some are abandoned copper mine sites. They commonly are reverting to brush. The Trimountain and Paavola soils are fairly well suited to cultivated crops, hay, and pasture. If cultivated crops are grown, controlling water erosion, reducing wetness, and maintaining the organic matter content and tilth are management concerns. A seasonal high water table, a low available water capacity, and surface compaction are the major concerns in managing pasture or hayland.

Broad Land Use Considerations

The general soil map is helpful in identifying broad areas that can be developed for residential, industrial, agricultural, and other uses. It cannot be used, however, in the selection of sites for specific structures or specific crops.

Soils that are severely limited as sites for urban development are extensive in the survey area. The soils in associations 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, and 12 are severely limited as sites for sewage disposal because of restricted permeability or a seasonal high water table. The slope is a limitation in most areas of associations 15, 16, 17, 18, 19, and 20 and in many areas of associations 13, 14, and 21. In many areas of associations 19, 20, and 21, the depth to bedrock is a limitation.

Areas that can be developed for agricultural uses are in associations 1, 4, and 7 and in most areas of

association 3. Most of the other associations are too wet, stony, rocky, or steep for these uses.

Most of the soils in the survey area are well suited or fairly well suited to woodland. The Arnheim soils in association 8 and the Lupton and Loxley soils in association 10, however, are poorly suited. Most of the associations support mixed northern hardwoods. Aspen stands are in scattered areas throughout the associations. Northern red oak and jack pine are dominant in areas of association 14. Lowland hardwoods and conifers are dominant in areas of associations 8, 10, and 12. On most of the soils in the survey area, the equipment limitation affects harvesting. The seasonal high water table is the major limitation in most of the wooded areas.

The slope and rockiness are limitations in associations 15, 16, 17, 18, 19, and 21.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Munising loamy fine sand, 1 to 8 percent slopes, is a phase of the Munising series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Munising-Yalmer complex, 1 to 8 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Lupton and Cathro mucks is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Dumps, stamp sand, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Some of the boundaries on the detailed soil maps of Houghton County do not match those on the soil maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences are the result of modifications or refinements in soil series concepts or variations in the intensity of mapping or in the extent of the soils in the survey area.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

10B—Munising loamy fine sand, 1 to 8 percent slopes. This very deep, nearly level and gently sloping, moderately well drained soil is on small knolls, broad

plains, and long side slopes. Individual areas are irregular in shape and range from 5 to 1,000 acres in size.

Typically, the surface layer is dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the firm or very firm layer is within a depth of 15 inches or does not occur. In some areas the upper part of the subsoil is sand. In a few areas the substratum is sandy.

Included with this soil in mapping are small areas of the somewhat poorly drained Skanee and poorly drained Gay soils in depressions and drainageways. Also included are small areas of the well drained Alcona soils in landscape positions similar to those of the Munising soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. A perched seasonal high water table is at a depth of 1 to 2 feet in spring and in other excessively wet periods. The available water capacity is low. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. The degree of saturation generally is higher on the lower parts of the slopes. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage, alter soil structure, and expose tree roots. Equipment should be used only when the soil is dry or has an adequate snow cover. On year-round logging roads, a gravel base is needed. The best sites for landings are the nearly level areas.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways (fig. 9) reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

This soil is well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIe. The Michigan soil management group is 3a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

10D—Munising loamy fine sand, 8 to 15 percent slopes. This very deep, gently rolling and rolling, moderately well drained soil is on knolls and side slopes. Individual areas are irregular in shape and range from 5 to 450 acres in size.

Typically, the surface layer is dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the firm or very firm layer is within a depth of 15 inches or does not occur. In some areas the upper part of the subsoil is sand. In a few areas the substratum is sandy.

Included with this soil in mapping are small areas of the somewhat poorly drained Skanee and poorly drained Gay soils in depressions and drainageways. These soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. A perched seasonal high water table

Figure 9.—A grassed waterway in an area of Munising loamy fine sand, 1 to 8 percent slopes.

is at a depth of 1 to 2 feet in the spring and in other excessively wet periods. The available water capacity is low. Runoff is slow.

Most areas are used as woodland. The equipment limitation, the windthrow hazard, and plant competition are management concerns. The use of equipment is limited in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage, alter soil structure, and expose tree roots. Equipment should be used only when the soil is dry or has an adequate snow cover. The slope limits the number of suitable landing sites. Landings can be established in small nearly level areas, if any are available, or in the nearly level adjacent areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. On year-round logging roads, a gravel base is needed.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is fairly well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

This soil is fairly well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soil is wet can

cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIIe. The Michigan soil management group is 3a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

10E—Munising loamy fine sand, 15 to 35 percent slopes. This very deep, hilly and steep, well drained soil is on knolls and side slopes. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the firm or very firm layer is within a depth of 15 inches or does not occur. In some areas the upper part of the subsoil is sand. In a few areas the substratum is sandy.

Included with this soil in mapping are small areas of the somewhat excessively drained Kalkaska soils. These soils are in landscape positions similar to those of the Munising soil. Also included are small areas of the somewhat poorly drained Skanee soils in depressions, drainageways, and seepy areas on side slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. The available water capacity is low. Runoff is medium.

Most areas are used as woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and in operating equipment. Logging roads can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. On the lower part of the slopes, the use of equipment is briefly restricted in spring and in other excessively wet periods. Year-round logging roads should be graveled.

Erosion can result from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, building logging roads on the contour or on the gentler slopes, and seeding logging roads, trails, and landings after the trees are logged help to prevent excessive soil loss.

Because of the firm layer in the lower part of the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management group is 3a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

11A—Skanee fine sandy loam, 0 to 3 percent slopes. This very deep, nearly level, somewhat poorly drained soil is in depressions and drainageways on broad plains. Individual areas are irregular in shape and range from 5 to 250 acres in size.

Typically, about 2 inches of black, well decomposed forest litter is on the surface. The surface layer is pinkish gray, mottled fine sandy loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is dark reddish brown, mottled, friable fine sandy loam; the next part is reddish brown, mottled, firm fine sandy loam; and the lower part is reddish brown, friable sandy clay loam. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places the upper part of the subsoil is sandy.

Included with this soil in mapping are small areas of the moderately well drained Munising and poorly drained Gay soils. Munising soils are on small knolls. Gay soils are in depressions. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Skanee soil, very slow in the next part, and moderate in the lower part. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet in spring and in other excessively wet periods. The available water capacity is low. Runoff is slow.

Most areas are used as woodland. The equipment

limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by wetness in late fall, in spring, and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Deep ruts can expose tree roots and restrict lateral drainage. Equipment should be used only when the soil is dry or has an adequate snow cover. Year-round logging roads should be graveled. Culverts are needed to maintain the natural drainage system. In some areas landings should be stabilized, so that they can withstand the repeated use of heavy equipment. The small areas of included Munising soils in the slightly higher landscape positions can be used as landing sites.

Because water is perched on the firm layer in the subsoil during wet periods and the surface layer is droughty during dry periods, seedling losses can be as high as 25 to 50 percent. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Because of the firm layer in the lower part of the subsoil and the water table, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest measures and site preparation may be needed to control the undesirable plants.

This soil is well suited to cropland. The major management concerns are seasonal wetness, deterioration of tilth, and the organic matter content. Grassed waterways help to remove surface water. If worked when too wet, the soil becomes cloddy and compacted. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and maintain good tilth. Limiting the use of equipment during wet periods also helps to maintain good tilth.

This soil is well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIw. The Michigan soil management group is 3b-af. The primary habitat type is TMC.

12—Gay muck. This very deep, nearly level, poorly drained soil is in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 5 to 250 acres in size.

Typically, the surface layer is about 5 inches of black muck and 3 inches of black mucky sandy loam. The subsoil is reddish brown, mottled, friable sandy loam about 16 inches thick. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some areas the soil has strata of finer textured material. In other areas the subsoil and substratum are sandy. In places the substratum is calcareous.

Included with this soil in mapping are small areas of the moderately well drained Munising soils on knolls. Also included are areas of the very poorly drained Cathro soils in the slightly lower landscape positions and the somewhat poorly drained Skanee soils on slight rises. Included soils make up about 10 to 15 percent of the unit.

Permeability is moderate in the Gay soil. The seasonal high water table is near or above the surface in spring and in other excessively wet periods. The available water capacity is moderate. Runoff is very slow or ponded.

This soil is used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soil is wet from fall to spring and can be wet in periods of heavy rainfall during other parts of the year. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. Roadfill and gravel are needed on year-round logging roads. Culverts are needed to maintain the natural drainage system. The number of suitable landing sites is severely limited because of the wetness.

Because of the seasonal high water table, seedling losses can be 25 to 50 percent and trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Trees generally are not planted on

this soil because of the wetness and plant competition.

The woodland ordination symbol is 7W. The land capability classification is Vw. The Michigan soil management group is 3c. The primary habitat type is FI, and the secondary habitat type is TTS.

14A—Assinins sand, 0 to 3 percent slopes. This very deep, nearly level, somewhat poorly drained soil is on broad flats and in depressions and drainageways. Individual areas are irregular in shape and range from 5 to 300 acres in size.

Typically, about 3 inches of black, well decomposed leaf litter is on the surface. The surface layer is very dark gray sand about 1 inch thick. The subsurface layer is pinkish gray sand about 13 inches thick. The subsoil is about 31 inches thick. The upper part is dark reddish brown, reddish brown, and brown, mottled, very friable sand, and the lower part is reddish brown, mottled, firm, mixed sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown fine sandy loam. In places depth to the loamy subsoil is more than 40 inches.

Included with this soil in mapping are scattered small areas of the moderately well drained Yalmer soils on low knolls and ridges. Also included are scattered small areas of the poorly drained Gay soils in the lower positions on the landscape. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the upper part of the Assinins soil, moderately slow in the next part, and moderate in the lower part. The seasonal high water table is at a depth of 0.5 to 1.0 foot in spring and in other excessively wet periods. The available water capacity is low. Runoff is slow.

This soil is used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in late fall, in spring, and in other excessively wet periods. Ruts form easily if wheeled skidders are used during these periods. Deep ruts expose tree roots and alter soil structure. Equipment should be used only when the soil is dry or has an adequate snow cover. Culverts are needed to maintain the natural drainage system. The small areas of included Yalmer soils in the slightly higher landscape positions can be used as landing sites.

Because this soil has a seasonal high water table and the surface layer is droughty during dry periods, seedling losses can be as high as 25 to 50 percent. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate.

Because of the seasonal high water table, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest measures and site preparation may be needed to control the undesirable plants.

The woodland ordination symbol is 3W. The land capability classification is IIIw. The Michigan soil management group is 4b. The primary habitat type is TMC.

15B—Kalkaska sand, 0 to 8 percent slopes. This very deep, nearly level and gently sloping, somewhat excessively drained soil is on low knolls and broad plains. Individual areas are irregular in shape and range from 5 to 250 acres in size.

Typically, about 1 inch of black, partially decomposed forest litter is on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Croswell soils in depressions. Also included are small areas of the excessively drained Waiska soils in landscape positions similar to those of the Kalkaska soil. Included soils make up about 10 percent of the unit.

Permeability is rapid in the Kalkaska soil. The available water capacity is low. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

The woodland ordination symbol is 3S. The land

capability classification is IVs. The Michigan soil management group is 5a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

15D—Kalkaska sand, 8 to 15 percent slopes. This very deep, gently rolling and rolling, somewhat excessively drained soil is on knolls and side slopes. Individual areas are irregular in shape and range from 5 to 200 acres in size.

Typically, about 1 inch of black, partially decomposed forest litter is on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with this soil in mapping are small areas of the well drained Keweenaw soils. These soils are slightly less droughty than the Kalkaska soil. Also included are small areas of Yalmer soils. These soils have a fragipan in the lower part of the subsoil. They are in landscape positions similar to those of the Kalkaska soil. Included soils make up about 10 percent of the unit.

Permeability is rapid in the Kalkaska soil. The available water capacity is low. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Landings can be established in small nearly level areas, if any are available. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

The woodland ordination symbol is 3S. The land capability classification is VIs. The Michigan soil management group is 5a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

15E—Kalkaska sand, 15 to 35 percent slopes. This very deep, hilly and steep, somewhat excessively drained soil is on hills and side slopes. Individual areas are irregularly shaped or elongated and range from 5 to 125 acres in size.

Typically, about 1 inch of black, partially decomposed forest litter is on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with this soil in mapping are small areas of the well drained Alcona soils. These soils have more silt and clay throughout than the Kalkaska soil. Also included are small areas of the excessively drained Waiska soils. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Kalkaska soil. The available water capacity is low. Runoff is slow or medium.

This soil is used as woodland. The equipment limitation, the erosion hazard, and seedling mortality are management concerns. The slope and the loose sand can interfere with the traction of wheeled equipment. The slope also limits the number of suitable sites for logging roads and landings. Logging roads and skid trails can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The number of suitable landing sites is very limited. Landings can be established in small nearly level areas, if any are available. Erosion results from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures helps to prevent excessive soil loss. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management group is 5a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

16B—Rubicon sand, 0 to 8 percent slopes. This very deep, nearly level and undulating, excessively drained soil is on broad plains and long side slopes. Individual areas are irregular in shape and range from 5 to 270 acres in size.

Typically, about 1 inch of black, well decomposed forest litter is on the surface. The surface layer is brown sand about 4 inches thick. The subsoil is dark brown

and brown, very friable sand about 24 inches thick. The substratum to a depth of about 60 inches is light brown sand. In places it is gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Au Gres soils in depressions and drainageways. These soils make up about 5 percent of the unit.

Permeability is rapid in the Rubicon soil. The available water capacity is low. Runoff is very slow.

Most areas are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate. Before the trees are planted, site preparation by mechanical or chemical means is needed to control undesirable plants.

The woodland ordination symbol is 4S. The land capability classification is VIs. The Michigan soil management group is 5.3a. The primary habitat type is AQVac, and the secondary habitat type is TMV.

16D—Rubicon sand, 8 to 15 percent slopes. This very deep, gently rolling and rolling, excessively drained soil is on knolls, ridges, and long side slopes. Individual areas are irregular in shape and range from 5 to 150 acres in size.

Typically, about 1 inch of black, well decomposed forest litter is on the surface. The surface layer is brown sand about 4 inches thick. The subsoil is dark brown and brown, very friable sand about 24 inches thick. The substratum to a depth of about 60 inches is light brown sand. In places it is gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Au Gres soils in depressions and drainageways. These soils make up about 5 percent of the unit.

Permeability is rapid in the Rubicon soil. The available water capacity is low. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Landings can be established in small nearly level areas, if any are available. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate. Before trees are planted, site preparation by mechanical or chemical means generally is needed to control plant competition.

The woodland ordination symbol is 4S. The land capability classification is VIs. The Michigan soil management group is 5.3a. The primary habitat type is AQVac, and the secondary habitat type is TMV.

17A—Croswell sand, 0 to 3 percent slopes. This very deep, nearly level, moderately well drained soil is on broad plains and in small depressions. Individual areas are irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is very dark gray sand about 1 inch thick. The subsurface layer is light gray and pinkish gray sand about 15 inches thick. The subsoil is brown and reddish yellow, loose sand about 15 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is reddish yellow, mottled sand. In places the mottles are closer to the surface.

Included with this soil in mapping are small areas of the poorly drained Roscommon soils in depressions and drainageways. Also included are small areas of the excessively drained Rubicon soils on knolls and ridges. Included soils make up about 10 to 15 percent of the unit.

Permeability is rapid in the Croswell soil. The seasonal high water table is at a depth of about 2 to 4 feet in spring and in other excessively wet periods. The available water capacity is low. Runoff is very slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Because of the seasonal high water table, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Undesirable plants that invade clear-cut areas can delay the establishment of planted trees. Before the trees are planted, site preparation by mechanical or

chemical means generally is needed to control the competing plants.

The woodland ordination symbol is 5S. The land capability classification is IVs. The Michigan soil management group is 5a. The primary habitat type is TMV, and the secondary habitat type is QAE.

18A—Au Gres sand, 0 to 3 percent slopes. This very deep, nearly level, somewhat poorly drained soil is on broad plains and in depressions and drainageways. Individual areas are irregularly shaped or long and narrow and range from 5 to 200 acres in size.

Typically, about 1 inch of black, well decomposed forest litter is on the surface. The surface layer is light brownish gray, mottled sand about 19 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, loose sand about 20 inches thick. The substratum to a depth of about 60 inches is brown sand. In some places the soil is gravelly or very gravelly sand throughout. In other places the substratum is loamy.

Included with this soil in mapping are small areas of the somewhat excessively drained Kalkaska soils on knolls and ridges. Also included are small areas of the poorly drained Roscommon soils in the lower landscape positions. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Au Gres soil. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet in spring and in other excessively wet periods. The available water capacity is low. Runoff is very slow.

This soil is used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in late fall, in spring, and in other excessively wet periods. Ruts form easily if wheeled skidders are used during these periods. Deep ruts expose tree roots and alter soil structure. Equipment should be used only when the soil is relatively dry or has an adequate snow cover or when the roads and landings are sufficiently frozen. Culverts are needed to maintain the natural drainage system. The small areas of included Kalkaska soils in the slightly higher landscape positions can be used as landing sites.

Because this soil has a seasonal high water table and the surface layer is droughty during dry periods, seedling losses can be as high as 25 to 50 percent. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Because of the seasonal high water table, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest measures and site preparation may be needed to control the undesirable plants.

The woodland ordination symbol is 6W. The land capability classification is IVw. The Michigan soil management group is 5b. The primary habitat type is TMC, and the secondary habitat type is TMC-Vac.

21B—Keweenaw-Kalkaska complex, 1 to 8 percent slopes. These very deep, nearly level and gently sloping soils are on knolls and broad plains. The Keweenaw soil is well drained, and the Kalkaska soil is somewhat excessively drained. Individual areas are irregular in shape and range from 10 to 900 acres in size. They are 45 to 60 percent Keweenaw soil and 30 to 45 percent Kalkaska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Keweenaw soil has a surface layer of black gravelly loamy sand about 2 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, very friable gravelly loamy sand; the next part is dark reddish brown and reddish brown, friable and very friable gravelly loamy sand; and the lower part is reddish brown, firm fine sandy loam and light reddish brown loamy fine sand. The substratum to a depth of about 60 inches is reddish brown loamy sand. In some areas the lower part of the subsoil is mottled.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are small areas of the moderately well drained Munising and Yalmer soils, which have a perched seasonal high water table, and some areas of the excessively drained Waiska soils. These included soils are in landscape positions similar to those of the Keweenaw and Kalkaska soils.

Also included are small areas of the poorly drained Roscommon soils in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the Keweenaw soil and rapid in the Kalkaska soil. The available water capacity is low in both soils. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas of the Kalkaska soil can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soil. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

These soils are fairly well suited to cropland. The major management concerns are water erosion, wind erosion, droughtiness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Contour stripcropping, buffer strips, and field windbreaks reduce the hazard of wind erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

These soils are well suited to pasture and hay. The major management concern is the low available water capacity. Proper stocking rates, rotation grazing, and restricted grazing during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Keweenaw soil is 3A, and that assigned to the Kalkaska soil is 3S. The land capability classification of both soils is IIIe. The Michigan soil management groups are 4a-a and 5a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

21D—Keweenaw-Kalkaska complex, 8 to 15 percent slopes. These very deep, gently rolling and rolling soils are on knolls, side slopes, and broad plains. The Keweenaw soil is well drained, and the Kalkaska soil is somewhat excessively drained. Individual areas are irregular in shape and range from 5 to 110 acres in size. They are 45 to 55 percent Keweenaw soil and 35 to 50 percent Kalkaska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Keweenaw soil has a surface layer of black gravelly loamy sand about 2 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, very friable gravelly loamy sand; the next part is dark reddish brown and reddish brown, friable and very friable gravelly loamy sand; and the lower part is reddish brown, firm fine sandy loam and light reddish brown loamy fine sand. The substratum to a depth of about 60 inches is reddish brown loamy sand. In some areas the lower part of the subsoil is mottled.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are small areas of the moderately well drained Munising and Yalmer soils, which have a perched seasonal high water table, and some areas of the excessively drained Waiska soils. These included soils are in landscape positions similar to those of the Keweenaw and Kalkaska soils. Also included are small areas of the poorly drained Roscommon soils in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the Keweenaw soil and rapid in the Kalkaska soil. The available water capacity is low in both soils. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas of the Kalkaska soil can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Landings can be established in small nearly level areas, if any are available.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soil. Planting

when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Crops generally are not grown on these soils because of the slope and the erosion hazard. Overcoming these limitations generally is not practical.

These soils are fairly well suited to pasture and hay. The major management concern is the low available water capacity. Proper stocking rates, rotation grazing, and restricted grazing during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Keweenaw soil is 3A, and that assigned to the Kalkaska soil is 3S. The land capability classification of both soils is IVe. The Michigan soil management groups are 4a-a and 5a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

22B—Abbaye-Munising loamy fine sands, 1 to 8 percent slopes. These moderately deep and very deep, nearly level and gently sloping, moderately well drained soils are on low knolls, side slopes, and broad plains. Individual areas are irregular in shape and range from 5 to 350 acres in size. They are 40 to 55 percent Abbaye soil and 35 to 50 percent Munising soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Abbaye soil has a surface layer of very dark gray loamy fine sand about 1 inch thick. The subsurface layer is reddish gray loamy fine sand about 5 inches thick. The subsoil is about 24 inches thick. In sequence downward, it is reddish brown, very friable fine sandy loam; brown, friable fine sandy loam; yellowish red and pinkish gray, firm fine sandy loam; and reddish brown and pinkish gray, mottled, firm sandy loam and loamy sand. Sandstone bedrock is at a depth of about 32 inches. In places the depth to sandstone bedrock is less than 20 inches.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places the firm or very firm layer is within a depth of 15 inches or does not occur. In other places the upper part of the subsoil is sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Zeba and Skanee soils in depressions and drainageways. Also included are small areas of the somewhat excessively drained Deerton soils in landscape positions similar to those of the Abbaye and Munising soils. Deerton soils are sandy throughout. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Abbaye soil. It is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. In spring and in other excessively wet periods, both soils have a perched seasonal high water table at a depth of 1 to 2 feet. The available water capacity is low. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, alter soil structure, and expose tree roots. Equipment should be used only when the soils are dry or have an adequate snow cover. Year-round logging roads should be graveled. The bedrock underlying the Abbaye soil can interfere with road building in some areas. The best sites for landings are the nearly level areas.

Because of the firm layer in the subsoil of the Munising soil and the depth to bedrock in the Abbaye soil, trees are shallow rooted on these soils. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Some areas are used as cropland, hayland, or pasture. These soils are fairly well suited to cultivated crops and well suited to hay and pasture. The major

management concerns are water erosion, droughtiness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways help to control runoff and erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIIe. The Michigan soil management groups are 3/Ra and 3a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

23A—*Zeba*-Jacobsville complex, 0 to 3 percent slopes. These moderately deep, nearly level soils are on broad plains. The somewhat poorly drained Zeba soil is on small flats and low knolls. The poorly drained Jacobsville soil is in depressions and drainageways. It is subject to ponding. Individual areas of these soils are irregular in shape and range from 5 to 200 acres in size. They are 45 to 65 percent Zeba soil and 20 to 35 percent Jacobsville soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Zeba soil has about 3 inches of black, well decomposed forest litter on the surface. The surface layer is gray fine sandy loam about 5 inches thick. The subsoil is reddish brown fine sandy loam about 30 inches thick. The upper part is friable, and the lower part is mottled and firm. Sandstone bedrock is at a depth of about 35 inches. In places the depth to sandstone bedrock is more than 40 inches.

Typically, the Jacobsville soil has a surface layer of black muck about 5 inches thick. The subsurface layer is dark reddish gray sandy loam about 4 inches thick. The subsoil is reddish brown, mottled, friable sandy loam about 14 inches thick. The substratum is reddish brown, mottled sandy loam about 13 inches thick. Sandstone bedrock is at a depth of about 36 inches. In places the depth to sandstone bedrock is more than 40 inches.

Included with these soils in mapping are small areas of the moderately well drained Abbaye and somewhat excessively drained Deerton soils. These included soils are in slightly elevated areas. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Zeba and Jacobsville soils. In spring and in other excessively wet periods, the Zeba soil has a seasonal high water table at a depth of 0.5 foot to 1.5 feet and the Jacobsville soil has one near or above the surface. The available water capacity is low in both soils. Runoff is slow on the Zeba soil and very slow or ponded on the Jacobsville soil.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soils are wet from fall to spring and can be wet during other periods. Ruts form easily if wheeled skidders are used during these periods. Deep ruts can expose tree roots and alter soil structure. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. Because of the wetness, the number of suitable landing sites is severely limited.

Because of the seasonal high water table and the depth to bedrock, seedling losses can be 25 to 50 percent and the trees are shallow rooted. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Many trees may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Tree planting is severely limited by the wetness and plant competition.

Some areas are used as hayland or pasture. These soils are fairly well suited to hay and pasture. The major management concerns are wetness and compaction. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

The woodland ordination symbol is 2W. The land capability classification is IIIw. The Michigan soil management group is 3/Rbc. The primary habitat type is TMC-D, and the secondary habitat type is TMC.

24B—Deerton sand, 1 to 8 percent slopes. This moderately deep, nearly level and gently sloping, somewhat excessively drained soil is on side slopes and broad plains. Individual areas are irregular in shape and range from 10 to 180 acres in size.

Typically, about 1 inch of black, partially decomposed forest litter is on the surface. The surface layer is

reddish brown sand about 8 inches thick. The subsoil is dark reddish brown, dark brown, and brown, friable and very friable sand about 19 inches thick. The substratum is highly weathered and fractured sandstone about 4 inches thick. Sandstone bedrock is at a depth of about 31 inches. In some places the depth to bedrock is less than 20 inches or more than 40 inches. In other places the lower part of the subsoil is mottled.

Included with this soil in mapping are small areas of Abbaye soils. These soils have a loamy subsoil and are in landscape positions similar to those of the Deerton soil. They make up 5 to 10 percent of the unit.

Permeability is rapid or moderately rapid in the Deerton soil. The available water capacity is low. Runoff is slow.

This soil is used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3D. The land capability classification is IVs. The Michigan soil management group is 4/Ra. The primary habitat type is ATD, and the secondary habitat type is TM.

25—Lupton and Cathro mucks. These very deep, nearly level, very poorly drained soils are in swamps and depressions. They are subject to ponding. Individual areas are irregular in shape and range from 5 to 1,500 acres in size. Some are made up of only one of the soils, and others are made up of both soils. The two soils are used and managed in such similar ways that separating them in mapping was not practical.

Typically, the Lupton soil is black muck to a depth of more than 60 inches. In places it has marl or has more than 10 inches of mucky peat within a depth of 51 inches.

Typically, the Cathro soil has a surface layer of black muck about 9 inches thick. The next 37 inches is black and very dark grayish brown muck. The substratum to a depth of about 60 inches is dark grayish brown fine sandy loam. In some places the substratum is sand or loamy sand. In other places the muck layer is less than 16 inches thick.

Included with these soils in mapping are areas of the poorly drained Gay and Roscommon soils. These included soils are along the edges of the mapped areas. Also included are small areas of the somewhat excessively drained Kalkaska and moderately well drained Munising soils on ridges and knolls. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow to moderately rapid in the Lupton soil. It is moderately slow to moderately rapid in the mucky part of the Cathro soil and moderate or moderately slow in the substratum. The seasonal high water table is near or above the surface of both soils in the spring. The available water capacity is high. Runoff is very slow or ponded.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on these soils. Special harvesting equipment is needed. The equipment can be used during periods in winter when access roads are frozen. On sites for year-round logging roads, fill, gravel, and culverts are needed.

Because of the wetness and the organic surface layer, the loss of natural seedlings can be more than 50 percent. Because of the wetness, trees on these soils are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After the trees are cut, plant competition can be expected to prevent or delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Because of the wetness, seedling mortality, and plant competition, trees are not planted on these soils.

The woodland ordination symbol assigned to the Lupton soil is 2W, and that assigned to the Cathro soil is 5W. The land capability classification of both soils is VIw. The Michigan soil management groups are Mc and M/3c. The primary habitat type is TTS.

26—Dawson and Loxley peats. These very deep, nearly level, very poorly drained soils are in swamps and bogs. They are subject to ponding. Individual areas are irregular in shape and range from 5 to 250 acres in

size. Some are made up of only one of the soils, and others are made up of both soils. The two soils are used and managed in such similar ways that separating them in mapping was not practical.

Typically, the Dawson soil has a surface layer of dark brown peat about 6 inches thick. The next layer is black mucky peat about 4 inches thick. The next 20 inches is very dark brown and black muck. The substratum to a depth of about 60 inches is very dark grayish brown and brown sand.

Typically, the Loxley soil has a surface layer of dark yellowish brown peat about 5 inches thick. The next 40 inches is black, very dark brown, and dark brown muck. Below this to a depth of about 60 inches is brown mucky peat.

Included with these soils in mapping are small areas of the poorly drained Kinross and Roscommon soils. These included soils are along the edges of the mapped areas. Also included are small areas of the excessively drained Rubicon soils on knolls and ridges. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic part of the Dawson soil and rapid in the substratum. It is moderate or moderately rapid in the Loxley soil. The seasonal high water table is near or above the surface of both soils in the spring. The available water capacity is high. Runoff is slow to ponded.

Most areas support native bog vegetation. Black spruce and tamarack are the most common tree species. Labrador tea, bog rosemary, and leatherleaf are the most common shrubs. These soils are generally unsuited to woodland because of extreme acidity, the instability of the organic matter, and the wetness. Overcoming these limitations is not practical.

The woodland ordination symbol is 2W. The land capability classification is VIIw. The Michigan soil management groups are M/4c-a and Mc-a. The primary habitat type is PCS.

27—Histosols and Aquents, ponded. These nearly level, very poorly drained soils are in depressions and along streams and the edges of lakes. The soils have a high water table at or above the surface throughout the year. The Histosols are organic, and the Aquents are sandy or loamy. Individual areas of these soils are irregularly shaped or oval and range from 5 to 400 acres in size. Some are made up entirely of either Histosols or Aquents, and others are made up of both soils.

Included with these soils in mapping are small areas of open water. These areas make up less than 20 percent of the unit.

Most of the acreage is marsh. The vegetation is mainly cattails, reeds, and grasses. Clumps of trees and shrubs are along the edges of the mapped areas. These soils provide habitat for waterfowl, beavers, muskrats, and other animals that prefer a wetland environment. They are generally unsuited to most other uses.

No interpretive groups are assigned to this unit.

29B—Waiska sand, 0 to 8 percent slopes. This very deep, nearly level and undulating, excessively drained soil is on terraces, low ridges, and small flats. Individual areas are irregular in shape and range from 5 to 300 acres in size.

Typically, about 1 inch of black, partially decomposed forest litter is on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand. In some places the subsoil is sand. In other places the lower part of the subsoil is mottled.

Included with this soil in mapping are small areas of the somewhat excessively drained Kalkaska soils. Also included are small areas of the moderately well drained Paavola soils, which have a firm layer in the lower part of the subsoil. They are in landscape positions similar to those of the Waiska soil. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the subsoil of the Waiska soil and very rapid in the substratum. The available water capacity is very low. Runoff is slow.

This soil is used as woodland. The major management concerns are seedling mortality and plant competition. The equipment limitation is only slight, but loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of

desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3S. The land capability classification is VIs. The Michigan soil management group is Ga. The primary habitat type is ATD, and the secondary habitat type is AVO.

30B—Munising-Skanee complex, 0 to 8 percent slopes. These very deep soils are on broad plains. The nearly level and undulating, moderately well drained Munising soil is on low knolls. The nearly level, somewhat poorly drained Skanee soil is in depressions and waterways. Individual areas of these soils are irregular in shape and range from 10 to 1,200 acres in size. They are 45 to 70 percent Munising soil and 20 to 50 percent Skanee soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the firm or very firm layer is within a depth of 15 inches or does not occur. In some areas the upper part of the subsoil is sand. In a few areas the substratum is sandy.

Typically, the Skanee soil has about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray, mottled fine sandy loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is dark reddish brown, mottled, friable fine sandy loam; the next part is reddish brown, mottled, firm fine sandy loam; and the lower part is reddish brown, friable sandy clay loam. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places the upper part of the subsoil is loamy sand.

Included with these soils in mapping are small areas of the poorly drained Gay and Roscommon soils in depressions. These included soils are on the lowest parts of the landscape. They make up 5 to 10 percent of the unit.

Permeability is very slow in the firm part of the subsoil in the Munising and Skanee soils and moderate in the rest of the profile. In spring and in other excessively wet periods, the Munising soil has a perched seasonal high water table at a depth of 1 to 2 feet and the Skanee soil has one at a depth of 0.5 foot to 1.5 feet (fig. 10). The Skanee soil remains wet for longer periods than the Munising soil. The available water capacity is low in both soils. Runoff is slow.

Figure 10.—A perched high water table in an area of Munising-Skanee complex, 0 to 8 percent slopes.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. When the soils are wet, unsurfaced logging roads are slippery and ruts form easily. Deep ruts can expose tree roots and restrict lateral drainage. Equipment should be used only when the soils are dry or have an adequate snow cover. Year-round logging roads should be graveled. Culverts are needed to maintain the natural drainage system. The best sites for landings are areas of the nearly level Munising soil.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Because of the firm layer in the subsoil and the seasonal high water table, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods and site preparation may be needed to control the undesirable plants.

These soils are well suited to cropland. The major management concerns are water erosion, seasonal wetness, deterioration of tilth, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and maintain good tilth.

These soils are well suited to pasture and hay. The major management concerns are compaction, the seasonal high water table, and the low available water capacity. Grassed waterways help to remove surface water. Overgrazing or grazing when the soils are wet can cause surface compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIe. The Michigan soil management groups are 3a-af and 3b-af. The primary habitat type is ATD, and the secondary habitat type is TMC.

31A—Skanee-Gay complex, 0 to 3 percent slopes. These very deep, nearly level soils are on till plains. The somewhat poorly drained Skanee soil is on low knolls. The poorly drained Gay soil is in depressions. It is subject to ponding. Individual areas of these soils are irregular in shape and range from 5 to 370 acres in size. They are 50 to 65 percent Skanee soil and 25 to 40 percent Gay soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Skanee soil has about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray, mottled fine sandy loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is dark reddish brown, mottled, friable fine sandy loam; the next part is reddish brown, mottled, firm fine sandy loam; and the lower part is reddish brown, friable sandy clay loam. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places the upper part of the subsoil is sandy.

Typically, the surface layer of the Gay soil is about 5 inches of black muck over 3 inches of black mucky sandy loam. The subsoil is reddish brown, mottled, friable sandy loam about 16 inches thick. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places the subsoil or substratum is sand.

Included with these soils in mapping are small areas of the moderately well drained Munising soils on knolls and ridges. These included soils make up 5 to 10 percent of the unit.

Permeability is very slow in the firm part of the subsoil in the Skanee soil and moderate in the rest of the profile. It is moderate in the Gay soil. In spring and in other excessively wet periods, the Skanee soil has a seasonal high water table at a depth of 0.5 foot to 1.5 feet and the Gay soil has one near or above the surface. Runoff is slow on the Skanee soil and very slow or ponded on the Gay soil. The available water capacity is low in the Skanee soil and moderate in the Gay soil.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soils are wet from fall to spring and can be wet during other periods. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts can expose tree roots and alter soil structure. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. Because of the wetness, the number of suitable landing sites is severely limited.

Because of the seasonal high water table, seedling losses can be 25 to 50 percent and the trees are shallow rooted. Some trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Tree planting is severely limited by the wetness and plant competition.

The woodland ordination symbol assigned to the Skanee soil is 3W, and that assigned to the Gay soil is 7W. The land capability classification of both soils is IIw. The Michigan soil management groups are 3b-af and 3c. The primary habitat type is TMC, and the secondary habitat type is FI.

32B—Alcona loamy fine sand, 1 to 8 percent slopes. This very deep, nearly level and gently sloping, well drained soil is on low knolls, side slopes, and small flats. Individual areas are irregularly shaped or elongated and range from 5 to 120 acres in size.

Typically, the surface layer is dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Richter soils in depressions and drainageways. Also included are small areas of the somewhat well drained, droughty Liminga soils in landscape positions similar to those of the Alcona soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Alcona soil. The available water capacity is moderate. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation and plant competition. The use of equipment is briefly limited in spring and in other excessively wet periods. When the soil is wet, unsurfaced logging roads tend to be slippery and ruts form easily. Year-round logging roads should be graveled. The best sites for landings are the nearly level areas.

Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is well suited to cropland. The major management concerns are water erosion and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

This soil is well suited to pasture and hay. There are no major management concerns.

The woodland ordination symbol is 3L. The land capability classification is IIe. The Michigan soil management group is 3a-s. The primary habitat type is ATD, and the secondary habitat type is TM.

33B—Munising-Yalmer complex, 1 to 8 percent slopes. These very deep, nearly level and gently sloping, moderately well drained soils are on low knolls and broad plains. Individual areas are irregular in shape and range from 5 to 900 acres in size. They are 40 to 55 percent Munising soil and 30 to 55 percent Yalmer soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the firm or very firm layer is within a depth of 15 inches or does not occur. In a few areas the substratum is sandy.

Typically, the Yalmer soil has about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray sand about 9 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is dark reddish brown, reddish brown, and yellowish red, very friable sand; reddish brown, firm loamy sand; reddish brown, mottled, firm, mixed fine sandy loam and loamy sand; and reddish brown, firm fine sandy loam. The substratum to a depth of about 60 inches is reddish brown fine sandy loam. In places depth to the firm part of the subsoil is more than 40 inches.

Included with these soils in mapping are small areas of the somewhat poorly drained Skanee and Assinins and poorly drained Gay soils in depressions and drainageways. Also included are small areas of the somewhat excessively drained Kalkaska soils in landscape positions similar to those of the Munising and Yalmer soils. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is rapid in the upper part of the Yalmer soil, very slow in the next part, and moderate in the lower part. In spring and in other excessively wet periods, the Munising soil has a perched seasonal high water table at a depth of 1 to 2 feet and the Yalmer soil has one at a depth of 1.5 to 2.0 feet. Runoff is slow on both soils. The available water capacity is low.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is limited in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in areas of the Yalmer soil can interfere with the traction of wheeled equipment during dry periods. The best sites for landings are the nearly level areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. On year-round logging roads, a gravel base is needed.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Yalmer soil. Planting when the soils are moist can reduce these losses. Because of the firm or very firm layer in the subsoil, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

These soils are fairly well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

These soils are well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Munising soil is 3W, and that assigned to the Yalmer soil is 3D. The land capability classification of both soils is IIe. The Michigan soil management groups are 3a-af and 4a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

33D—Munising-Yalmer complex, 8 to 15 percent slopes. These very deep, gently rolling and rolling, moderately well drained soils are on knolls, ridges, and side slopes. Individual areas are irregular in shape and range from 5 to 260 acres in size. They are 40 to 60 percent Munising soil and 30 to 55 percent Yalmer soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the firm or very firm layer is within a depth of 15 inches or does not occur. In a few areas the substratum is sandy.

Typically, the Yalmer soil has about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray sand about 9 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is dark reddish brown, reddish brown, and yellowish red, very friable sand; reddish brown, firm loamy sand; reddish brown, mottled, firm, mixed fine sandy loam and loamy sand; and reddish brown, firm fine sandy loam. The substratum to a depth of about 60 inches is reddish brown fine sandy loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Skanee and Assinins soils in depressions and drainageways. Also included are small areas of the excessively drained Kalkaska

soils in landscape positions similar to those of the Munising and Yalmer soils. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is rapid in the upper part of the Yalmer soil, very slow in the next part, and moderate in the lower part. In spring and in other excessively wet periods, the Munising soil has a perched seasonal high water table at a depth of 1 to 2 feet and the Yalmer soil has one at a depth of 1.5 to 2.0 feet. Runoff is slow on both soils. The available water capacity is low.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is limited in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in areas of the Yalmer soil can interfere with the traction of wheeled equipment during dry periods. The slope limits the number of suitable landing sites. Landings can be established in small nearly level areas, if any are available, or in the nearly level adjacent areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. On year-round logging roads, a gravel base is needed.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Yalmer soil. Planting when the soils are moist can reduce these losses. Because of the firm or very firm layer in the subsoil, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Crops generally are not grown on these soils because of the slope and the erosion hazard. Overcoming these limitations generally is not practical.

These soils are fairly well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Munising soil is 3W, and that assigned to the Yalmer soil is 3D. The land capability classification of both soils is IVe. The Michigan soil management groups are 3a-af and 4a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

34B—Munising loamy fine sand, dissected, 1 to 12 percent slopes. This very deep, nearly level to moderately sloping, moderately well drained soil is in dissected areas on uplands where mainly parallel ravines are 50 to 300 feet apart. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of this soil are irregularly shaped or elongated and range from 10 to 600 acres in size.

Typically, the surface layer is dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the firm or very firm layer is within a depth of 15 inches or does not occur. In some areas the upper part of the subsoil is sand. In a few areas the substratum is sand.

Included with this soil in mapping are areas of somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and small areas of the somewhat excessively drained Kalkaska soils in landscape positions similar to those of the Munising soil. Also included are some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. A perched seasonal high water table is at a depth of 1 to 2 feet in spring and in other

excessively wet periods. Runoff is medium on the sides of the ravines and slow between the ravines. The available water capacity is low.

Most areas are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In these areas, however, the use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soil is dry or has an adequate snow cover. On year-round logging roads, a gravel base is needed. If the side slopes of the ravines are disturbed, erosion is a moderate hazard. As a result, logging roads and skid trails should be established in the less sloping areas between the ravines or diagonally across the side slopes. Suitable landing sites can be located between the ravines in gently sloping areas.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is fairly well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

This soil is well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIIe. The Michigan soil management group is 3a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

34D—Munising loamy fine sand, dissected, 8 to 35 percent slopes. This very deep, moderately sloping to steep, well drained soil is on dissected uplands. Ridgetops are dominantly 25 to 200 feet wide and are moderately sloping. The ravines are dominantly parallel, 10 to 30 feet deep, and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of this soil are irregular in shape and range from 5 to 220 acres in size.

Typically, the surface layer is dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the firm or very firm layer is within a depth of 15 inches or does not occur. In some areas the upper part of the subsoil is sand. In a few areas the substratum is sand.

Included with this soil in mapping are areas of somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are small areas of the somewhat excessively drained Kalkaska soils in landscape positions similar to those of the Munising soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. The available water capacity is low. Runoff is medium on the sides of the ravines and slow between the ravines.

This soil is used as woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. In some of these areas, however, the use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced logging roads are slippery and ruts form easily. Year-round logging roads

should be graveled. The number of suitable landing sites is limited because of the slope and the ravines. A few of the gently sloping included areas can be used as sites for landings.

If the side slopes of the ravines are disturbed, erosion is a moderate hazard. It results from the concentration of runoff on skid trails, on logging roads, and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes helps to control erosion. Seeding the roads, trails, and landings after the trees are logged also helps to control erosion.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management group is 3a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

34E—Munising loamy fine sand, dissected, 15 to 60 percent slopes. This very deep, moderately steep to very steep, well drained soil is on dissected uplands. Ridgetops are dominantly moderately steep or steep and are 15 to 100 feet wide. The ravines are dominantly parallel, 15 to 50 feet deep, and 40 to 150 feet wide and have moderately steep to very steep side slopes. The ravine bottoms are 10 to 20 feet wide. Some have seasonal streams. Individual areas of this soil are irregular in shape and range from 5 to 360 acres in size.

Typically, the surface layer is dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the firm or very firm layer is within a depth of 15 inches or does not occur. In some areas the upper part of the subsoil is sand. In a few areas the substratum is sand.

Included with this soil in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some areas where the ravine bottoms have exposures of bedrock. Also included are small areas of the excessively drained Kalkaska soils in landscape positions similar to those of the Munising soil. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. The available water capacity is low. Runoff is medium on the sides of the ravines and slow between the ravines.

This soil is used as woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Access is easiest on the ridgetops and on the bottoms of the ravines. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced logging roads are slippery and ruts form easily. On year-round logging roads, a gravel base is needed. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep to very steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management group is 3a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

35B—Graveraet loam, 1 to 8 percent slopes. This very deep, nearly level and gently sloping, moderately well drained soil is on low knolls and broad plains. Individual areas are irregular in shape and range from 5 to 500 acres in size.

Typically, the surface layer is black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, mottled, firm fine sandy loam and reddish brown, mottled, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In some places the upper part of the subsoil is sandy. In other places sandstone bedrock is within a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Misery soils in depressions and drainageways. These soils make up about 5 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. A perched seasonal high water table is at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low.

Most areas are used as woodland. The equipment limitation, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. The degree of saturation generally is higher on the lower part of the slopes. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage and expose tree roots. Equipment should be used only when the soil is dry or has an adequate snow cover. Year-round logging roads should be graveled. The best sites for landings are the nearly level areas.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

This soil is well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIe. The Michigan soil management group is 2.5a-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

35D—Graveraet loam, 8 to 15 percent slopes. This very deep, gently rolling and rolling, moderately well drained soil is on knolls and ridges. Individual areas are irregular in shape and range from 5 to 180 acres in size.

Typically, the surface layer is black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, mottled, firm fine sandy loam and reddish brown, mottled, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In places the upper part of the subsoil is sandy.

Included with this soil in mapping are small areas of the somewhat poorly drained Misery and poorly drained Gay soils. These soils are in depressions and drainageways. They make up about 5 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. A perched seasonal high water table is at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low.

Most areas are used as woodland. The equipment limitation, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. The degree of saturation generally is higher on the lower part of the slopes. Small flats or benches

remain wet for longer periods than the more sloping areas. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soil is dry or has an adequate snow cover. Year-round logging roads should be graveled. The slope limits the number of suitable landing sites. Landings can be established in small nearly level areas, if any are available, and in the nearly level adjacent areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is fairly well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

This soil is fairly well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIIe. The Michigan soil management group is 2.5a-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

35E—Graveraet loam, 15 to 35 percent slopes. This very deep, hilly and steep, well drained soil is on knolls and side slopes. Individual areas are irregular in shape and range from 5 to 180 acres in size.

Typically, the surface layer is black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, firm fine sandy loam and reddish brown, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In places the upper part of the subsoil is sandy.

Included with this soil in mapping are small areas of the somewhat excessively drained Kalkaska soils. These soils are in landscape positions similar to those of the Graveraet soil. Also included are small areas of the somewhat poorly drained Misery soils. These soils are in depressions, drainageways, and seepy areas on side slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. The available water capacity is low. Runoff is medium.

Most areas are used as woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and in operating equipment. Logging roads can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. On the lower part of the slopes, the use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled.

Erosion can result from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, building logging roads on the contour or on the gentler slopes, and seeding logging roads, trails, and landings after the trees are logged help to prevent excessive soil loss.

Because of the firm layer in the lower part of the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is

needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management group is 2.5a-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

36A—Sturgeon silt loam. This very deep, nearly level, somewhat poorly drained soil is on flood plains. It is occasionally flooded. Individual areas are irregularly shaped or elongated and range from 5 to 150 acres in size.

Typically, the surface layer is reddish brown silt loam about 8 inches thick. The upper part of the substratum is reddish brown, mottled very fine sandy loam, silt loam, and loamy very fine sand, and the lower part to a depth of about 60 inches is dark reddish gray fine sand. In places the lower part of the substratum is loamy. In other places the soil is fine sand or loamy fine sand throughout.

Included with this soil in mapping are small areas of the poorly drained Arnheim soils in depressions and drainageways. Also included are small areas of the moderately well drained Pelkie soils in the higher landscape positions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Sturgeon soil and rapid in the lower part. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is moderate.

Most areas are used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is briefly restricted in spring and in other excessively wet periods. Equipment should be used only when the soil is dry or has an adequate snow cover. When the soil is wet, unsurfaced logging roads are slippery and ruts form easily. Year-round logging roads should be graveled. Landings can be used only during dry periods. They should be stabilized, so that they can withstand the repeated use of heavy equipment. The small areas of included Pelkie soils in the slightly higher landscape positions can be used as sites for landings.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent. Timely planting and the selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate.

Because of the seasonal high water table, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Some areas are used as hayland, pasture, or cropland. This soil is well suited to hay and pasture and fairly well suited to cultivated crops. The major management concerns are the flooding, deterioration of tilth, and the organic matter content. A surface drainage system helps to remove floodwater. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material improve tilth and increase the organic matter content.

In the areas used as pasture, overgrazing or grazing when the soil is wet can cause compaction and reduce yields. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIIw. The Michigan soil management group is L-2b. The primary habitat type is AVO-CI, and the secondary habitat type is ATD-CI.

37—Arnheim silt loam. This very deep, nearly level, poorly drained soil is on elongated flood plains. It is subject to flooding. Individual areas range from 5 to 600 acres in size.

Typically, the surface layer is reddish brown silt loam about 4 inches thick. The upper part of the substratum is dark reddish gray, mottled silt loam; the next part is reddish brown, mottled silt loam; and the lower part to a depth of about 60 inches is brown and dark brown, stratified loamy fine sand, very fine sandy loam, and fine sand. In some places the surface layer is muck 6 to 12 inches thick. In other places the substratum has a layer of muck.

Included with this soil in mapping are small areas of the somewhat poorly drained Sturgeon soils. These soils are in slightly elevated areas. Also included are small areas of organic soils in old stream channels. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Arnheim soil. The seasonal high water table is at or near the surface in

spring and in other excessively wet periods. Runoff is very slow or ponded. The available water capacity is moderate.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soil is usually wet from fall to spring and can be wet during other periods. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Roadfill and gravel are needed on year-round logging roads. Culverts are needed to improve drainage. The number of suitable landing sites is severely limited because of the wetness.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent and trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Trees generally are not planted on this soil because of the wetness and plant competition.

The woodland ordination symbol is 5W. The land capability classification is Vw. The Michigan soil management group is L-2c. The primary habitat type is FMC, and the secondary habitat type is FI.

38A—Pelkie loamy fine sand, 0 to 3 percent slopes. This very deep, nearly level, moderately well drained soil is on flood plains. It is subject to flooding. Individual areas are irregularly shaped or elongated and range from 5 to 40 acres in size.

Typically, the surface layer is reddish brown loamy fine sand about 7 inches thick. The substratum to a depth of about 60 inches is reddish brown loamy fine sand and light reddish brown, mottled fine sand. In some places the upper part of the substratum is loamy. In other places the substratum is not mottled.

Included with this soil in mapping are small areas of the somewhat poorly drained Sturgeon and poorly drained Arnheim soils. These soils are less droughty than the Pelkie soil. They make up 5 to 15 percent of the unit.

Permeability is rapid in the Pelkie soil. The seasonal high water table is at a depth of 2.5 to 5.0 feet in spring and in other excessively wet periods. Runoff is very slow. The available water capacity is low.

Most areas are used as woodland. The major management concern is plant competition. Logging may be delayed by flooding after snowmelt in the spring. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Some areas are used as cropland, hayland, or pasture. This soil is poorly suited to cultivated crops and fairly well suited to hay and pasture. The major management concerns are the flooding, droughtiness, and the organic matter content. A surface drainage system helps to remove floodwater. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3A. The land capability classification is IVs. The Michigan soil management group is L-4a. The primary habitat type is AVO.

41A—Misery very fine sandy loam, 0 to 3 percent slopes. This very deep, nearly level, somewhat poorly drained soil is in depressions and drainageways on broad plains. Individual areas are irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is black very fine sandy loam about 4 inches thick. The subsurface layer is dark reddish gray, mottled very fine sandy loam about 3 inches thick. The subsoil is about 31 inches thick. The upper part is reddish brown, mottled, friable very fine sandy loam; the next part is reddish brown, mottled, firm loam mixed with light brown, firm fine sandy loam; and the lower part is reddish brown, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In places the upper part of the subsoil is sand or loamy sand.

Included with this soil in mapping are small areas of the moderately well drained Graveraet and poorly drained Gay soils. Graveraet soils are on small knolls. Gay soils are in depressions. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Misery soil, very slow in the next part, and moderate or moderately slow in the lower part. The seasonal high

water table is at a depth of 0.5 foot to 1.5 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by wetness in late fall, in spring, and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Deep ruts can expose tree roots and restrict lateral drainage. Equipment should be used only when the soil is dry or has an adequate snow cover. Year-round logging roads should be graveled. Culverts are needed to maintain the natural drainage system. In some areas landings should be stabilized, so that they can withstand the repeated use of heavy equipment. The small areas of included Graveraet soils in the slightly higher landscape positions can be used as sites for landings.

Because water is perched on the firm layer in the subsoil during wet periods and because the surface layer is droughty during dry periods, seedling losses can be as high as 25 to 50 percent. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Because of the firm layer in the lower part of the subsoil and the water table, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods and site preparation may be needed to control the undesirable plants.

The woodland ordination symbol is 3W. The land capability classification is IIw. The Michigan soil management group is 3b-af. The primary habitat type is TMC.

45—Pits, borrow. This map unit consists of open excavations from which soil material has been removed for use as fill. The excavations are 3 to 40 feet deep. Some areas have been excavated below the seasonal high water table. These areas are ponded part of the year. Individual areas of this unit are elongated or oval and range from 3 to 15 acres in size.

Most areas are idle. Some are active borrow pits. Onsite investigation is needed to determine specific soil properties.

No interpretive groups are assigned to this unit.

46B—Karlin-Kalkaska complex, 0 to 8 percent slopes. These very deep, nearly level and gently sloping, somewhat excessively drained soils are on knolls and broad plains. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are 45 to 60 percent Karlin soil and 35 to 50 percent Kalkaska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Karlin soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is dark gray fine sandy loam about 3 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown and brown, friable fine sandy loam, and the lower part is brown, loose sand. The substratum to a depth of about 60 inches is strong brown sand.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are small areas of the well drained Alcona and moderately well drained Halfaday soils. Alcona soils have finer textures than the Karlin and Kalkaska soils. Also, they are in similar landscape positions. Halfaday soils are in the slightly lower landscape positions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Karlin soil and rapid in the lower part. It is rapid in the Kalkaska soil. The available water capacity is low in both soils. Runoff is slow.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas of the Kalkaska soil can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soil. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Karlin soil is 3A, and that assigned to the Kalkaska soil is 3S. The land capability classification of both soils is IVs. The Michigan soil management groups are 4a and 5a. The primary habitat type is ATD, and the secondary habitat type is TMV.

46D—Karlin-Kalkaska complex, 8 to 15 percent slopes. These very deep, gently rolling and rolling, somewhat excessively drained soils are on side slopes, knolls, and broad plains. Individual areas are irregular in shape and range from 5 to 250 acres in size. They are 40 to 60 percent Karlin soil and 35 to 50 percent Kalkaska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Karlin soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is dark gray fine sandy loam about 3 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown and brown, friable fine sandy loam, and the lower part is brown, loose sand. The substratum to a depth of about 60 inches is strong brown sand.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are small areas of the well drained Alcona and moderately well drained Halfaday soils. Alcona soils have finer textures than the Karlin and Kalkaska soils. Also, they are in similar landscape positions. Halfaday soils are in the slightly lower landscape positions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Karlin soil and rapid in the lower part. It is rapid in the Kalkaska soil. The available water capacity is low in both soils. Runoff is slow.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas of the Kalkaska soil can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soil. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Karlin soil is 3A, and that assigned to the Kalkaska soil is 3S. The land capability classification of both soils is IVs. The Michigan soil management groups are 4a and 5a. The primary habitat type is ATD, and the secondary habitat type is TMV.

47B—Ocqueoc-Halfaday complex, 0 to 8 percent slopes. These very deep, nearly level and gently sloping, moderately well drained soils are on low knolls and broad plains. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are 45 to 60 percent Ocqueoc soil and 35 to 50 percent Halfaday soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Ocqueoc soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish brown fine sand about 4 inches thick. The subsoil is very friable fine sand about 24 inches thick. The upper part is dark reddish brown and dark brown, and the lower part is brown and mottled. The substratum to a depth of about 60 inches is stratified, reddish brown and brown, mottled very fine sandy loam, loamy fine sand, and loamy very fine sand.

Typically, the Halfaday soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is pinkish gray sand about 3 inches thick. The subsoil is dark reddish brown, yellowish red, and

strong brown, friable sand about 27 inches thick. The substratum to a depth of about 60 inches is light brown, mottled sand. In some places the mottles are closer to the surface. In other places the soil is fine sand throughout.

Included with these soils in mapping are small areas of the well drained Alcona and poorly drained Roscommon soils. Alcona soils are in the slightly higher positions on the landscape. Roscommon soils are in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the upper part of the Ocqueoc soil and moderately slow in the lower part. It is rapid in the Halfaday soil. In spring and in other excessively wet periods, the Ocqueoc soil has a seasonal high water table at a depth of 2.5 to 6.0 feet and the Halfaday soil has one at a depth of 2.0 to 3.5 feet. The available water capacity is low in the Halfaday soil and moderate in the Ocqueoc soil. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3S. The land capability classification is IIIs. The Michigan soil management groups are 4/2a and 5a. The primary habitat type is ATD-D, and the secondary habitat type is TMC.

51A—Allendale-Rudyard complex, 0 to 3 percent slopes. These very deep, nearly level, somewhat poorly drained soils are on low knolls and broad plains. Individual areas are irregular in shape and range from 5 to 30 acres in size. They are 45 to 60 percent Allendale soil and 30 to 45 percent Rudyard soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Allendale soil has a surface layer of dark brown sand about 7 inches thick. The subsurface layer is brown, mottled sand about 5 inches thick. The subsoil is about 33 inches thick. The upper part is dark brown and brown, mottled, very friable sand, and the lower part is reddish brown, mottled, firm silty clay. The substratum to a depth of about 60 inches is reddish brown silty clay. In places depth to the clayey textures is more than 40 inches.

Typically, the Rudyard soil has a surface layer of dark reddish brown silt loam about 4 inches thick. The subsurface layer is reddish gray, mottled silt loam about 5 inches thick. The subsoil is clay about 15 inches thick. The upper part is dark reddish brown, mottled, and firm, and the lower part is reddish brown, mottled, and very firm. The substratum to a depth of about 60 inches is reddish brown clay.

Included with these soils in mapping are small areas of the moderately well drained Manistee and poorly drained Bergland soils. Manistee soils are in the slightly higher positions on the landscape. Bergland soils are in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the upper part of the Allendale soil and very slow in the lower part. It is very slow in the Rudyard soil. In spring and in other excessively wet periods, the Allendale soil has a seasonal high water table at a depth of 1 to 2 feet and the Rudyard soil has one at a depth of 0.5 foot to 1.5 feet. Runoff is slow on both soils. The available water capacity is low in the Allendale soil and moderate in the Rudyard soil.

Most areas are used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in late fall, in spring, and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in heavily traveled areas of the Allendale soil can interfere with the traction of wheeled equipment, especially during dry periods. Year-round logging roads should be graveled.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent and trees are shallow rooted. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Some trees may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized

by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. If trees are planted, site preparation by mechanical or chemical means generally is needed to control plant competition.

Some areas are used as hayland, pasture, or cropland. These soils are well suited to hay and pasture and fairly well suited to cultivated crops. The major management concerns are the seasonal high water table, the low available water capacity, and the organic matter content. A surface drainage system helps to remove excess water. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Allendale soil is 4W, and that assigned to the Rudyard soil is 6W. The land capability classification of both soils is IIIw. The Michigan soil management groups are 4/1b and Ob. The primary habitat type is ATD, and the secondary habitat type is TMC.

52B—Allouez gravelly silt loam, 1 to 8 percent slopes. This very deep, nearly level and gently sloping, well drained soil is on low ridges and broad plains. Individual areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is dark reddish brown gravelly silt loam about 7 inches thick. The subsoil is about 11 inches thick. The upper part is dark reddish brown, friable very gravelly fine sandy loam, and the lower part is dark reddish brown, loose extremely gravelly coarse sand. The substratum to a depth of about 60 inches is dark brown extremely gravelly coarse sand.

Included with this soil in mapping are small areas of the moderately well drained Paavola soils. These soils have a fragipan in the lower part of the subsoil. They make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Allouez soil and very rapid in the lower part. The available water capacity is very low. Runoff is very slow.

This soil is used as woodland. The major management concern is plant competition. The equipment limitation is only slight, but trafficability may be briefly limited after snowmelt and in other excessively wet periods, when unsurfaced logging roads and skid trails are slippery and ruts form easily. The substratum is a good source of roadfill. Northern hardwoods are the dominant species on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3A. The land capability classification is VIs. The Michigan soil management group is Ga. The primary habitat type is AVO.

55—Dumps, mine. This map unit consists of piles or areas of waste rock from past copper mining. Some of the waste rock is in large piles, and some has been leveled. The dumps include piles of waste rock that is dominantly cobble sized, angular or flaggy fragments. Individual areas are oval or irregular in shape and range from 3 to 70 acres in size.

Included in this unit in mapping are small areas of mineral soils between the piles of waste rock. The mineral soils are the same as those mapped in areas adjacent to this unit. Also included are some mine shafts, most of which have been filled in or capped.

Some of the very old waste piles are partially revegetated around the edges. This unit is poorly suited to woodland and recreational uses. Some areas are used as roadfill and riprap. Some piles have been crushed and used as road gravel.

No interpretive groups are assigned to this unit.

56—Jacobsville muck. This moderately deep, nearly level, poorly drained soil is in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 5 to 140 acres in size.

Typically, the surface layer is black muck about 5 inches thick. The subsurface layer is dark reddish gray, mottled sandy loam about 4 inches thick. The subsoil is reddish brown, mottled, friable sandy loam about 14 inches thick. The substratum to a depth of about 36 inches is reddish brown, mottled sandy loam. Sandstone bedrock is at a depth of about 36 inches. In some places the depth to sandstone bedrock is more than 40 inches. In other places the soil is sandy throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Zeba soils. These soils

are in slightly elevated areas. Also included are small areas of the very poorly drained Cathro soils in the slightly lower landscape positions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Jacobsville soil. The seasonal high water table is near or above the surface in spring and in other excessively wet periods. Runoff is very slow or ponded. The available water capacity is low.

This soil is used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soil is usually wet from fall to spring and can be wet during other periods. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. Because of the wetness, the number of suitable landing sites is severely limited and the expected seedling mortality rate is 25 to 50 percent.

Because of the seasonal high water table and the depth to bedrock, trees on this soil are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to prevent or delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Trees generally are not planted on this soil because of the wetness and plant competition.

The woodland ordination symbol is 2W. The land capability classification is Vw. The Michigan soil management group is 3/Rbc. The primary habitat type is TTS, and the secondary habitat type is FI.

58B—Manistee-Ontonagon complex, dissected, 1 to 12 percent slopes. These very deep, nearly level to moderately sloping, moderately well drained and well drained soils are on dissected lake plains that have ravines 50 to 350 feet apart. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 130 acres in size. They are 45 to 60 percent Manistee soil and 30 to 45 percent Ontonagon soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Manistee soil has a surface layer of dark brown sand about 7 inches thick. The subsurface layer is brown sand about 4 inches thick. The subsoil is about 39 inches thick. The upper part is dark brown, friable sand; the next part is brown, mottled, very friable sand; and the lower part is reddish brown, mottled, firm silty clay. The substratum to a depth of about 60 inches is reddish brown silty clay loam. In places the soil is sand throughout.

Typically, the Ontonagon soil has a surface layer of dark reddish brown silt loam about 7 inches thick. The subsoil is about 17 inches thick. The upper part is reddish brown, firm clay mixed with reddish gray silty clay loam, and the lower part is reddish brown, very firm clay. The substratum to a depth of about 60 inches is reddish brown clay. In some places sandy or loamy material is below a depth of 50 inches. In other places stratified silt, silt loam, and silty clay loam are in the subsoil and substratum.

Included with these soils in mapping are small areas of the somewhat poorly drained Allendale and Rudyard soils in the slightly lower positions on the landscape. Also included are poorly drained, sandy and loamy soils on the ravine bottoms. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the upper part of the Manistee soil and very slow in the lower part. It is very slow in the Ontonagon soil. In spring and in other excessively wet periods, the Manistee soil has a seasonal high water table at a depth of 2.5 to 4.0 feet. The available water capacity is moderate in both soils. Runoff is slow.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. The use of equipment is also restricted on the Ontonagon soil for short periods in spring and in other excessively wet periods. When the soils are wet, unsurfaced logging roads are slippery and ruts form easily. Deep ruts in areas of the Manistee soil can expose tree roots and restrict lateral drainage. Loose sand in heavily traveled areas of the Manistee soil can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Manistee soil. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery

stock also reduces the seedling mortality rate. Because of the firm layer in the lower part of the subsoil in both soils and the seasonal high water table in the Manistee soil, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Manistee soil is 3S, and that assigned to the Ontonagon soil is 2C. The land capability classification of both soils is IIIs. The Michigan soil management groups are 4/1a and Oa. The primary habitat type is ATD, and the secondary habitat type is TM.

59B—Graveraet-Ocqueoc-Kalkaska complex, 1 to 8 percent slopes. These very deep, nearly level and gently sloping soils are on low knolls and broad plains. The Graveraet and Ocqueoc soils are moderately well drained, and the Kalkaska soil is somewhat excessively drained. Individual areas are irregular in shape and range from 10 to 450 acres in size. They are 40 to 65 percent Graveraet soil, 15 to 35 percent Ocqueoc soil, and 15 to 35 percent Kalkaska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Graveraet soil has a surface layer of black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, mottled, firm fine sandy loam and reddish brown, mottled, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In some areas the surface layer or the upper part of the subsoil is sandy.

Typically, the Ocqueoc soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish brown fine sand about 4 inches thick. The subsoil is very friable fine sand about 24 inches thick. The upper part is dark reddish brown and dark brown, and the lower part is brown and mottled. The substratum to a depth of about 60 inches is stratified, reddish brown and brown, mottled very fine sandy loam, loamy fine sand, and loamy very fine sand.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 4 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and brown and very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places the lower part of the subsoil and the substratum are mottled. In other places layers of gravelly sand are in the substratum.

Included with these soils in mapping are small areas of the somewhat poorly drained Misery and Au Gres soils and the poorly drained Gay and Roscommon soils in depressions and drainageways. These included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. It is rapid in the sandy upper part of the Ocqueoc soil and moderately slow in the loamy lower part. It is rapid in the Kalkaska soil. In spring and in other excessively wet periods, the Graveraet soil has a seasonal high water table at a depth of 1 to 2 feet and the Ocqueoc soil has one at a depth of 2.5 to 6.0 feet. The available water capacity is low in the Graveraet and Kalkaska soils and moderate in the Ocqueoc soil. Runoff is slow.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is limited in spring and in other excessively wet periods. The upper part of the subsoil in the Graveraet soil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in areas of the Kalkaska and Ocqueoc soils can interfere with the traction of wheeled equipment during dry periods. The best sites for landings are the nearly level areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. On year-round logging roads, a gravel base is needed.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska and Ocqueoc soils. Planting when the soils are moist can reduce these losses. Because of the firm or very firm layer in the subsoil of the Graveraet soil, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils.

Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

These soils are fairly well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

If these soils are used as hayland or pasture, the major management concerns are compaction, the seasonal high water table, and the low available water capacity. Grassed waterways help to remove excess water. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Graveraet soil is 3W, and that assigned to the Kalkaska and Ocqueoc soils is 3S. The land capability classification of all three soils is IIIe. The Michigan soil management groups are 2.5a-af, 4/2a, and 5a. The primary habitat type is ATD, and the secondary habitat type is AVO.

60B—Nunica-Fence complex, dissected, 1 to 12 percent slopes. These very deep, nearly level to moderately sloping soils are on dissected uplands. The Nunica soil is well drained, and the Fence soil is moderately well drained. The uplands have parallel ravines 50 to 300 feet apart. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 200 acres in size. They are 40 to 50 percent Nunica soil and 35 to 50 percent Fence soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Nunica soil has a surface layer of reddish brown silt loam about 3 inches thick. The next 6 inches is brown, firm silt loam mixed with reddish brown silty clay loam. The subsoil is about 12 inches of reddish brown, firm silty clay loam mixed with reddish gray silt loam. The substratum to a depth of about 60 inches is red and reddish brown, stratified silt loam and silty clay loam. In some places the substratum is sandy. In other places the subsoil and substratum are clayey.

Typically, the Fence soil has about 2 inches of black, partially decomposed forest litter on the surface. The surface layer is reddish brown very fine sandy loam about 2 inches thick. The subsoil is friable very fine sandy loam about 40 inches thick. The upper part is reddish brown and brown, and the lower part is reddish brown and mottled. The substratum to a depth of about 60 inches is reddish brown silt loam and very fine sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, loamy soils in depressions and on the ravine bottoms and small areas of the well drained Liminga soils. Liminga soils are in landscape positions similar to those of the Nunica and Fence soils. They are sandy. Their available water capacity is lower than that of the Nunica and Fence soils. Also included are some ravines that are 15 to 30 feet deep and 50 to 100 feet wide and have moderately steep to very steep side slopes. Included areas make up about 8 percent of the unit.

Permeability is moderately slow in the Nunica and Fence soils. The available water capacity is high. The Fence soil has a seasonal high water table at a depth of 2 to 6 feet in the spring. Runoff is medium on the sides of the ravines and slow between the ravines.

Most areas are used as woodland. The major management concerns are the equipment limitation and plant competition. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In these areas, however, the use of equipment is restricted in spring and in other excessively wet periods because of the sticky and plastic qualities of the subsoil in the Nunica soil and the seasonal high water table in the Fence soil. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. A gravel base is needed on year-round logging roads.

Mixed hardwoods and conifers are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is

needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Some areas are used as cropland. These soils are fairly well suited to cultivated crops. The major management concerns are water erosion, seasonal wetness, the organic matter content, and deterioration of tilth. Cover crops, close-growing crops, and grassed waterways help to control runoff and erosion. Working the soils when they are wet results in compaction and the formation of clods. Returning crop residue to the soils, applying a system of conservation tillage, and adding organic material improve tilth and increase the content of organic matter.

These soils are well suited to pasture and hay. Preventing excessive compaction is the major management concern. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

The woodland ordination symbol is 3L. The land capability classification is IIIe. The Michigan soil management groups are 1.5a and 3a. The primary habitat type is TTL.

60D—Nunica-Fence complex, dissected, 8 to 35 percent slopes. These very deep, well drained, moderately sloping to steep soils are on dissected uplands. Ridgetops are dominantly moderately sloping or strongly sloping and are 50 to 200 feet wide. The ravines are 10 to 35 feet deep and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 200 acres in size. They are 45 to 55 percent Nunica soil and 40 to 50 percent Fence soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Nunica soil has a surface layer of reddish brown silt loam about 3 inches thick. The next 6 inches is brown, firm silt loam mixed with reddish brown silty clay loam. The subsoil is about 12 inches of reddish brown, firm silty clay loam mixed with reddish gray silt loam. The substratum to a depth of about 60 inches is red and reddish brown, stratified silt loam and silty clay loam. In some places the substratum is sandy. In other places the subsoil and substratum are clayey.

Typically, the Fence soil has about 2 inches of black, partially decomposed forest litter on the surface. The surface layer is reddish brown very fine sandy loam about 2 inches thick. The subsoil is friable very fine sandy loam about 40 inches thick. The upper part is reddish brown and brown, and the lower part is reddish brown. The substratum to a depth of about 60 inches is reddish brown silt loam and very fine sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, loamy soils on the ravine bottoms and small areas of the well drained Liminga soils. Liminga soils are in landscape positions similar to those of the Nunica and Fence soils. They are sandy. Their available water capacity is lower than that of the Nunica and Fence soils. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Nunica and Fence soils. The available water capacity is high. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The major management concerns are the equipment limitation, the erosion hazard, and plant competition. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. In the areas between the ravines, however, the use of equipment is restricted for a short time in spring and in other excessively wet periods. Unsurfaced logging roads are slippery and ruts form easily during these periods. The number of suitable landing sites is severely limited in areas of these soils. Year-round logging roads should be graveled.

If the side slopes of the ravines are disturbed, erosion is a moderate hazard. The concentration of runoff on skid trails and roads and in the tracks of wheeled equipment can increase the hazard of erosion. As a result, logging roads and skid trails should be established on the ridgetops, on the ravine bottoms, or diagonally across the side slopes. Seeding the roads, trails, and landings after the trees are logged also helps to control erosion.

Mixed hardwoods and conifers are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management groups are 1.5a and 3a. The primary habitat type is TTL.

60E—Nunica-Fence complex, dissected, 15 to 60 percent slopes. These very deep, well drained, moderately steep to very steep soils are on dissected uplands. Ridgetops are dominantly moderately steep or steep and are 15 to 100 feet wide. The ravines are 15 to 50 feet deep and 40 to 150 feet wide and have very steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 150 acres in size. They are 45 to 55 percent Nunica soil and 30 to 50 percent Fence soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Nunica soil has a surface layer of reddish brown silt loam about 3 inches thick. The next 6 inches is brown, firm silt loam mixed with reddish brown silty clay loam. The subsoil is about 12 inches of reddish brown, firm silty clay loam mixed with reddish gray silt loam. The substratum to a depth of about 60 inches is red and reddish brown, stratified silt loam and silty clay loam. In some places the substratum is sandy. In other places the subsoil and substratum are clayey.

Typically, the Fence soil has about 2 inches of black, partially decomposed forest litter on the surface. The surface layer is reddish brown very fine sandy loam about 2 inches thick. The subsoil is friable very fine sandy loam about 40 inches thick. The upper part is reddish brown and brown, and the lower part is reddish brown. The substratum to a depth of about 60 inches is reddish brown silt loam and very fine sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, loamy soils on the ravine bottoms and small areas of the well drained Liminga soils. Liminga soils are in landscape positions similar to those of the Nunica and Fence soils. They are sandy. Their available water capacity is lower than that of the Nunica and Fence soils. Included soils make up about 10 percent of the unit.

Permeability is moderately slow in the Nunica and Fence soils. The available water capacity is high. Runoff is medium.

These soils are used as woodland. The major management concerns are the equipment limitation, the erosion hazard, and plant competition. The use of equipment is restricted by the dissected landscape. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special operations, such as yarding logs with a cable, may be needed. Access is easiest on the ridgetops and on the bottoms of ravines. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soils are wet, unsurfaced roads are slippery and ruts form easily. A gravel base is needed on year-round logging roads. Suitable landing sites are generally not available because of the slope and the ravines.

The erosion hazard is severe. Erosion can result from the concentration of runoff on skid trails and in the tracks of wheeled equipment. Cable logging from the ridgetops can minimize disturbance of the side slopes. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding disturbed areas after the trees are logged help to prevent excessive soil loss.

Because of the dissected landscape and the steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can be managed by various cutting practices. Special harvest methods may be needed to control competition from undesirable plants.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 1.5a and 3a. The primary habitat type is TTL.

61B—Ontonagon silt loam, 1 to 6 percent slopes. This very deep, nearly level and gently sloping, well drained soil is on broad plains. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is dark reddish brown silt loam about 7 inches thick. The subsoil is about 17 inches thick. The upper part is reddish brown, firm clay mixed with reddish gray silty clay loam, and the lower part is reddish brown, very firm clay. The substratum to a depth of about 60 inches is reddish brown clay. In some places sandy or loamy material is below a depth of 50 inches. In other places stratified silt, silt loam, and loamy very fine sand are in the subsoil and substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Rudyard soils in depressions and drainageways. Also included are small areas of the moderately well drained Manistee soils in landscape positions similar to those of the Ontonagon soil. Included soils make up about 8 percent of the unit.

Permeability is very slow in the Ontonagon soil. The available water capacity is moderate. Runoff is slow in wooded areas and medium in cultivated areas.

Some areas of this soil are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is limited in spring and in other excessively wet periods by the very slow permeability and the sticky and plastic qualities of the subsoil. Operating equipment during wet periods can result in

compaction and can damage tree roots. When the soil is wet, unsurfaced roads and landings are slippery and ruts form easily. A gravel base is needed on year-round logging roads.

Because of the firm subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Some areas are used as cropland. This soil is fairly well suited to cultivated crops. The major management concerns are water erosion, the organic matter content, and deterioration of tilth. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Working the soil when it is wet results in compaction and the formation of clods. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material improve tilth and increase the content of organic matter.

Most areas are used as pasture and hayland. This soil is well suited to these uses. Preventing excessive compaction is the major management concern. Overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

The woodland ordination symbol is 2C. The land capability classification is IIIe. The Michigan soil management group is 0a. The primary habitat type is TTL, and the secondary habitat type is TM.

61D—Ontonagon silt loam, 6 to 15 percent slopes. This very deep, gently rolling and rolling, well drained soil is on side slopes and broad plains. Individual areas are irregular in shape and range from 5 to 90 acres in size.

Typically, the surface layer is dark reddish brown silt loam about 7 inches thick. The subsoil is about 17 inches thick. The upper part is reddish brown, firm clay mixed with reddish gray silty clay loam, and the lower part is reddish brown, very firm clay. The substratum to a depth of about 60 inches is reddish brown clay. In some places sandy or loamy material is below a depth of 50 inches. In other places stratified silt, silt loam, and loamy very fine sand are in the subsoil and substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Rudyard soils in depressions and drainageways. Also included are small areas of the moderately well drained Manistee soils in landscape positions similar to those of the Ontonagon soil. Included soils make up about 8 percent of the unit.

Permeability is very slow in the Ontonagon soil. The available water capacity is moderate. Runoff is slow in wooded areas and medium in cultivated areas.

Some areas of this soil are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is limited in spring and in other excessively wet periods because of the very slow permeability and the sticky and plastic qualities of the subsoil. Operating equipment during wet periods can result in compaction and can damage tree roots. When the soil is wet, unsurfaced roads and landings are slippery and ruts form easily. A gravel base is needed on year-round logging roads.

Because of the firm subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Crops are not grown on this soil because of the slope and the erosion hazard. Overcoming these limitations generally is not practical.

Most areas are used as pasture and hayland. This soil is well suited to these uses. Preventing excessive compaction is the major management concern. Overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

The woodland ordination symbol is 2C. The land capability classification is IVe. The Michigan soil management group is 0a. The primary habitat type is TTL, and the secondary habitat type is TM.

61E—Ontonagon silt loam, 15 to 35 percent slopes. This very deep, moderately steep and steep,

well drained soil is on short, steep side slopes along waterways and streams. Individual areas are linear or irregular in shape and range from 5 to 75 acres in size.

Typically, the surface layer is dark reddish brown silt loam about 7 inches thick. The subsoil is about 17 inches thick. The upper part is reddish brown, firm clay mixed with reddish gray silty clay loam, and the lower part is reddish brown, very firm clay. The substratum to a depth of about 60 inches is reddish brown clay. In some places sandy or loamy material is below a depth of 50 inches. In other places stratified silt and silt loam are in the subsoil and substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Rudyard and poorly drained Bergland soils in depressions and drainageways. Also included are small areas of the well drained, droughty Liminga soils in landscape positions similar to those of the Ontonagon soil. Included soils make up 5 to 10 percent of the unit.

Permeability is very slow in the Ontonagon soil. The available water capacity is moderate. Runoff is rapid.

This soil is used as woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and in operating equipment. Logging roads can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced logging roads are slippery and ruts form easily. A gravel base is needed on year-round logging roads. Suitable landing sites generally are not available.

Erosion can result from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, building skid trails on the contour or on the gentler slopes, and seeding roads and trails after the trees are logged help to prevent excessive soil loss.

Because of the firm subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Mixed hardwoods and conifers are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 2R. The land capability classification is VIIe. The Michigan soil management group is 0a. The primary habitat type is TTL, and the secondary habitat type is TM.

65A—Rudyard silt loam, 0 to 3 percent slopes. This very deep, nearly level, somewhat poorly drained soil is on broad plains. Individual areas are irregular in shape and range from 5 to 125 acres in size.

Typically, the surface layer is dark reddish brown silt loam about 4 inches thick. The subsurface layer is reddish gray, mottled silt loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is dark reddish brown, mottled, firm clay, and the lower part is reddish brown, mottled, very firm clay. The substratum to a depth of about 60 inches is reddish brown clay.

Included with this soil in mapping are small areas of the well drained Ontonagon and poorly drained Pickford soils. Ontonagon soils are in the slightly higher positions on the landscape. Pickford soils are in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is very slow in the Rudyard soil. The available water capacity is moderate. A perched seasonal high water table is at a depth of 0.5 foot to 1.5 feet in spring and in other excessively wet periods. Runoff is slow.

In areas used as woodland, the equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is limited in fall, in spring, and in other excessively wet periods because of the sticky and plastic qualities of the subsoil. Operating equipment during wet periods can result in compaction and can damage tree roots. Equipment should be used only when the soil is dry or has an adequate snow cover. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled and should be drained by culverts. In some areas landings should be stabilized, so that they can withstand the repeated use of heavy equipment. The small areas of included Ontonagon soils in the slightly higher landscape positions can be used as sites for landings.

Seedling losses can be as high as 25 to 50 percent. Special site preparation, such as bedding or drainage measures, can reduce the seedling mortality rate. Because of the seasonal high water table and the firm subsoil, trees on this soil are shallow rooted. Some may

be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay regeneration unless precautionary measures are applied. Special harvest methods and site preparation may be needed to control the undesirable plants.

Many areas are used as cropland, hayland, or pasture. This soil is fairly well suited to cultivated crops and is well suited to hay and pasture. The major management concerns are wetness, deterioration of tilth, the organic matter content, and compaction. Working the soil when it is wet results in compaction and the formation of clods. Grassed waterways provide an adequate means of removing surface water. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic matter improve tilth and increase the content of organic matter.

In the areas used as pasture, overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

The woodland ordination symbol is 6W. The land capability classification is IIIw. The Michigan soil management group is 0b. The primary habitat type is TTP, and the secondary habitat type is TAM-Eq.

66B—Munising-Abbaye-Kalkaska complex, dissected, 1 to 12 percent slopes, rocky. These nearly level to moderately sloping soils are on dissected uplands. The Munising soil is very deep and moderately well drained. The Abbaye soil is moderately deep and moderately well drained. The Kalkaska soil is very deep and somewhat excessively drained. The uplands have parallel ravines 45 to 300 feet apart. The ravines are 5 to 15 feet deep and 20 to 50 feet wide and have strongly sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Most have seasonal streams. Many have sandstone ledges and waterfalls. Individual areas of these soils are elongated or irregular in shape and range from 15 to 500 acres in size. They are 40 to 60 percent Munising soil, 20 to 40 percent Abbaye soil, and 12 to 25 percent Kalkaska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places the firm or very firm layer is within a depth of 15 inches or does not occur. In other places the upper part of the subsoil is sand. In some areas the substratum is sand.

Typically, the Abbaye soil has a surface layer of very dark gray loamy fine sand about 1 inch thick. The subsurface layer is reddish gray loamy fine sand about 5 inches thick. The subsoil is about 24 inches thick. In sequence downward, it is reddish brown, very friable fine sandy loam; brown, friable fine sandy loam; yellowish red and pinkish gray, firm fine sandy loam; and reddish brown and pinkish gray, mottled, firm sandy loam and loamy sand. Sandstone bedrock is at a depth of about 32 inches. In places the depth to sandstone bedrock is less than 20 inches.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. The ravines have seasonal streams and moderately steep to very steep side slopes. Also included are areas of rock outcrop and very shallow soils. Included areas make up about 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is moderate in the Abbaye soil and rapid in the Kalkaska soil. In spring and in other excessively wet periods, the Munising and Abbaye soils have a perched seasonal high water table at a depth of 1 to 2 feet. The available water capacity is low in all three soils. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In spring and in

other excessively wet periods, however, trafficability is briefly limited in these areas. The upper part of the subsoil in the Munising and Abbaye soils is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in areas of the Kalkaska soil can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. Suitable landing sites are available between the ravines in a few gently sloping areas.

The erosion hazard is moderate or severe on the side slopes of the ravines. As a result, logging roads and skid trails should be established in the less sloping areas between the ravines or should be built diagonally across the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soil. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the seasonal high water table in the Munising and Abbaye soils, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are the dominant species on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Munising and Abbaye soils is 3W, and that assigned to the Kalkaska soil is 3S. The land capability classification of all three soils is VIs. The Michigan soil management groups are 3a-af, 3/Ra, and 5a. The primary habitat type is ATD, and the secondary habitat type is TM.

66D—Munising-Abbaye-Kalkaska complex, dissected, 8 to 35 percent slopes, rocky. These moderately sloping to steep soils are on dissected uplands. The Munising soil is very deep and well drained. The Abbaye soil is moderately deep and well drained. The Kalkaska soil is very deep and somewhat excessively drained. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 150 feet wide. The parallel ravines are 10 to 45 feet deep and 20 to 100 feet wide and have moderately steep or steep side slopes. Most have seasonal streams. Many have sandstone ledges and waterfalls. The ravine bottoms are 5 to 25 feet wide. Individual areas of these soils are elongated or irregular in shape and range from 15 to 500 acres in size. They are 40 to 55 percent Munising soil, 25 to 35 percent Abbaye soil, and 15 to 30 percent Kalkaska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places the firm layer is within a depth of 15 inches or does not occur. In other places the upper part of the subsoil is sand. In a few areas the substratum is sandy.

Typically, the Abbaye soil has a surface layer of very dark gray loamy fine sand about 1 inch thick. The subsurface layer is reddish gray loamy fine sand about 5 inches thick. The subsoil is about 24 inches thick. In sequence downward, it is reddish brown, very friable fine sandy loam; brown, friable fine sandy loam; yellowish red and pinkish gray, firm fine sandy loam; and reddish brown and pinkish gray, firm sandy loam and loamy sand. Sandstone bedrock is at a depth of about 32 inches. In places the depth to sandstone bedrock is less than 20 inches.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In places layers of gravelly sand are in the substratum.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are areas of rock outcrop and very shallow soils. Included areas make up about 5 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is moderate in the Abbaye soil and rapid in the Kalkaska soil. The available water capacity

is low in all three soils. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape and the slope. Access is easiest on the ridgetops. In spring and in other excessively wet periods, the use of equipment is briefly restricted on the Munising and Abbaye soils. When the soils are wet, unsurfaced roads are slippery and ruts form easily. Loose sand in areas of the Kalkaska soil can interfere with the traction of wheeled equipment during dry periods. The number of suitable landing sites is limited by the slope and the ravines. A few gently sloping areas between the ravines may be suitable for use as sites for landings.

If the side slopes of the ravines are disturbed, erosion is a moderate hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the bottoms of the ravines, or diagonally across the side slopes and seeding the roads after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soil. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the firm layer in the subsoil of the Munising soil and the bedrock underlying the Abbaye soil, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the trees widely spaced. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Northern hardwoods are the dominant species on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management groups are 3a-af, 3/Ra, and 5a. The primary habitat type is ATD, and the secondary habitat type is TM.

66F—Munising-Abbaye-Kalkaska complex, dissected, 15 to 70 percent slopes, rocky. These moderately steep to very steep soils are on dissected uplands. The Munising soil is very deep and well drained. The Abbaye soil is moderately deep and well drained. The Kalkaska soil is very deep and somewhat excessively drained. Ridgetops are dominantly moderately steep or steep and are 10 to 75 feet wide. The parallel ravines are 20 to 120 feet deep and 50 to 300 feet wide and have very steep side slopes. The ravine bottoms are 5 to 35 feet wide. Most have seasonal streams. Many have sandstone ledges and waterfalls. Individual areas of these soils are elongated or irregular in shape and range from 25 to 500 acres in size. They are 25 to 55 percent Munising soil, 25 to 45 percent Abbaye soil, and 15 to 30 percent Kalkaska soil.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places the firm layer is within a depth of 15 inches or does not occur. In other places the upper part of the subsoil is sand. In a few areas the substratum is sandy.

Typically, the Abbaye soil has a surface layer of very dark gray loamy fine sand about 1 inch thick. The subsurface layer is reddish gray loamy fine sand about 5 inches thick. The subsoil is about 24 inches thick. In sequence downward, it is reddish brown, very friable fine sandy loam; brown, friable fine sandy loam; yellowish red and pinkish gray, firm fine sandy loam; and reddish brown and pinkish gray, firm sandy loam and loamy sand. Sandstone bedrock is at a depth of about 32 inches. In places the depth to sandstone bedrock is less than 20 inches.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are areas of rock outcrop and very shallow soils. Included areas make up about 5 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is moderate in the Abbaye soil and rapid in the Kalkaska soil. The available water capacity is low in all three soils. Runoff is medium.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape and the slope. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Logging roads and skid trails should be located on the bottoms of the ravines or on the ridgetops. In spring and in other excessively wet periods, the use of equipment is briefly restricted on the Munising and Abbaye soils. When the soils are wet, unsurfaced logging roads are slippery and ruts form easily. Loose sand in areas of the Kalkaska soil can interfere with the traction of wheeled equipment during dry periods. The number of suitable landing sites is severely limited by the slope. A few sites may be available in small gently sloping areas.

The erosion hazard is severe on the side slopes of the ravines. Cable logging from the ridgetops minimizes disturbance of the side slopes. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, establishing logging roads and skid trails on the contour, and seeding disturbed areas after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soil. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the dissected landscape and the very steep side slopes of the ravines, however, site preparation and machine planting are difficult or impractical. Because of the firm layer in the subsoil of the Munising soil and the bedrock underlying the Abbaye soil, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the trees widely spaced.

Northern hardwoods are the dominant species on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 3a-af, 3/Ra, and 5a. The primary habitat type is ATD, and the secondary habitat type is TM.

67—Roscommon muck. This very deep, nearly level, poorly drained soil is in depressions and drainageways. It is subject to ponding. Individual areas are irregular or elongated and range from 10 to 180 acres in size.

Typically, the surface layer is black muck and mucky sand about 6 inches thick. The substratum to a depth of about 60 inches is light brownish gray and pale brown sand. In places the lower part of the substratum is loamy.

Included with this soil in mapping are small areas of the somewhat poorly drained Au Gres soils. These soils are in slightly elevated areas. Also included are the very poorly drained Tawas soils in the slightly lower landscape positions. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Roscommon soil. The seasonal high water table is near or above the surface in spring and in other excessively wet periods. Runoff is very slow or ponded. The available water capacity is low.

This soil is used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soil is usually wet from fall to spring and can be wet in periods of heavy rainfall during other parts of the year. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. On year-round logging roads, roadfill and a gravel base are needed. Culverts are needed to maintain the natural drainage system. The number of suitable landing sites is severely limited because of the wetness.

Because of the wetness, seedling losses can exceed 50 percent. Because of the seasonal high water table and the depth to bedrock, trees on this soil are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Trees generally are not planted on this soil because of the wetness and plant competition.

The woodland ordination symbol is 6W. The land capability classification is VIw. The Michigan soil management group is 5c. The primary habitat type is

TMC, and the secondary habitat type is TTS.

68—Dumps, stamp sand. This map unit consists of waste material from past copper mining. The material consists of sand-sized waste material from copper stamping mills. Most of the sand was deposited in Torch Lake, Portage Lake, and Lake Superior by pipeline and formed delta-like deposits. A few areas of this unit are located inland near the copper mines. Most areas are gently sloping. A few are moderately steep. The water table is near the surface along the edges of the unit and is at a depth of more than 10 feet near the center. Individual areas of this unit are oval or irregular in shape and range from 5 to 100 acres in size.

This unit is poorly suited to most uses. It is very susceptible to wind erosion. Attempts at stabilization have generally been futile unless topsoil has been applied. The stamp sand has been utilized as road sanding material in winter and raw material for cement blocks. Some areas have been used for sewage lagoon systems, and some are used for snowmobile and automobile racing.

No interpretive groups are assigned to this unit.

69B—Watton-Alstad loams, 0 to 8 percent slopes. These very deep soils are on broad plains. The nearly level and gently sloping, well drained Watton soil is on low knolls. The nearly level, somewhat poorly drained Alstad soil is in depressions and drainageways. Individual areas of these soils are irregular in shape and range from 5 to 200 acres in size. They are 40 to 55 percent Watton soil and 35 to 50 percent Alstad soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Watton soil has a surface layer of reddish brown loam about 7 inches thick. The subsoil is about 29 inches thick. The upper part is reddish brown, firm, mixed clay loam and loam, and the lower part is reddish brown, firm clay loam. The substratum to a depth of about 60 inches is reddish brown clay loam. In some places a thin dark reddish brown layer is in the upper part of the subsoil. In other places the surface layer is cobbly.

Typically, the Alstad soil has a surface layer of dark reddish brown loam about 5 inches thick. The subsurface layer is reddish brown, mottled loam about 2 inches thick. The subsoil is about 22 inches thick. The upper part is reddish brown, mottled, firm, mixed clay loam and loam; the next part is reddish brown, mottled, firm clay loam; and the lower part is reddish brown, firm clay loam. The substratum to a depth of about 60 inches is reddish brown loam. In places the surface layer is cobbly.

Included with these soils in mapping are small areas of poorly drained, loamy soils in the lowest depressions. These included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in both soils. In spring and in other excessively wet periods, the Alstad soil has a perched seasonal high water table at a depth of 1 to 3 feet. The available water capacity is high in both soils. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is limited in fall, in spring, and in other excessively wet periods. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are relatively dry or have an adequate snow cover. When the soils are wet, unsurfaced roads are slippery and are easily rutted. Year-round logging roads should be graveled and should be drained by culverts. Landing sites are generally available only during the driest periods. Measures that stabilize the landings may be needed.

Because of the firm layer in the subsoil of the Watton soil and the seasonal high water table in the Alstad soil, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent regeneration unless precautionary measures are applied. Special harvest methods and site preparation may be needed to control the undesirable plants. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are well suited to cropland. If they are cultivated, the major management concerns are water erosion, the organic matter content, and deterioration of tilth. Working the soils when they are wet results in compaction and the formation of clods. Returning crop residue to the soils, applying a system of conservation tillage, and adding organic matter improve tilth and increase the content of organic matter. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion.

These soils are well suited to pasture and hay. The major management concerns are wetness and compaction. Grassed waterways help to remove surface

water. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Watton soil is 3A, and that assigned to the Alstad soil is 3W. The land capability classification of both soils is IIe. The Michigan soil management groups are 1.5a and 1.5b. The primary habitat type is ATD, and the secondary habitat type is TMC.

70B—Watton loam, 1 to 8 percent slopes. This very deep, nearly level and gently sloping, well drained soil is on broad plains and low knolls. Individual areas are irregular in shape and range from 5 to 160 acres in size.

Typically, the surface layer is reddish brown loam about 7 inches thick. The subsoil is about 29 inches thick. The upper part is reddish brown, firm, mixed clay loam and loam, and the lower part is reddish brown, firm clay loam. The substratum to a depth of about 60 inches is reddish brown clay loam. In some places a thin dark reddish brown layer is in the upper part of the subsoil. In other places the surface layer is cobbly.

Included with this soil in mapping are small areas of the somewhat poorly drained Alstad soils in depressions and drainageways. These soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Watton soil. The available water capacity is high. Runoff is slow in wooded areas and slow or medium in cultivated areas.

About half of the acreage of this soil is woodland. The major management concerns are the equipment limitation and plant competition. The use of equipment is briefly limited in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. The best sites for landings are the nearly level areas. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is well suited to cropland. If the soil is cultivated, the major management concerns are water erosion, the organic matter content, and deterioration of tilth. Working the soil when it is wet results in compaction and the formation of clods. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic matter improve tilth and increase the content of organic matter. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion.

This soil is well suited to pasture and hay. Preventing compaction is a major management concern. Overgrazing or grazing when the soil is wet can cause compaction and reduce yields. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

The woodland ordination symbol is 3A. The land capability classification is IIe. The Michigan soil management group is 1.5a. The primary habitat type is ATD, and the secondary habitat type is AVO.

71A—Richter very fine sandy loam, 0 to 3 percent slopes. This very deep, nearly level, somewhat poorly drained soil is in depressions and drainageways. Individual areas are irregular in shape and range from 5 to 60 acres in size.

Typically, about 4 inches of black, well decomposed forest litter is on the surface. The surface layer is pinkish gray very fine sandy loam about 5 inches thick. The subsoil is about 36 inches thick. It is friable and mottled. The upper part is brown very fine sandy loam; the next part is strong brown, stratified loamy very fine sand and loamy fine sand; and the lower part is brown and reddish brown, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is strong brown and brown, mottled, stratified fine sand and loamy fine sand.

Included with this soil in mapping are small areas of the well drained Alcona soils. These soils are in slightly elevated areas. Also included are small areas of the somewhat poorly drained Au Gres soils in landscape positions similar to those of the Richter soil. Au Gres soils are sand. Their available water capacity is lower than that of the Richter soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Richter soil. The seasonal high water table is at a depth of 1.0 to 1.5 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is moderate.

This soil is used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is limited in fall and spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used during these periods. Deep ruts can expose tree roots and alter soil

structure. Equipment should be used only when the soil is dry or has an adequate snow cover. Year-round logging roads should be graveled. Culverts are needed to maintain the natural drainage system. The use of landing sites is restricted to dry periods. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. The small areas of included Alcona soils in the slightly higher landscape positions can be used as sites for landings.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent and trees are shallow rooted. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Some trees may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. If trees are planted, site preparation by mechanical or chemical means may be needed to control the competing vegetation.

The woodland ordination symbol is 3W. The land capability classification is IIw. The Michigan soil management group is 3b-s. The primary habitat type is TMC, and the secondary habitat type is ATD.

72A—Halfaday sand, 0 to 3 percent slopes. This very deep, nearly level, moderately well drained soil is on broad plains and in small depressions. Individual areas are irregular in shape and range from 5 to 120 acres in size.

Typically, about 1 inch of black, partially decomposed forest litter is on the surface. The surface layer is pinkish gray sand about 3 inches thick. The subsoil is dark reddish brown, yellowish red, and strong brown, friable sand about 27 inches thick. The substratum to a depth of about 60 inches is light brown and reddish brown, mottled sand. In some places the mottles are closer to the surface. In other places the soil is fine sand throughout. In some areas loamy or silty material is below a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat excessively drained Kalkaska soils on knolls and ridges. Also included are small areas of the poorly drained Roscommon soils in depressions and drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Halfaday soil. The available water capacity is low. The seasonal high water table is at a depth of 2.0 to 3.5 feet in the spring. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3S. The land capability classification is IIIs. The Michigan soil management group is 5a. The primary habitat type is ATD-D, and the secondary habitat type is TMC.

73B—Froberg-Rudyard silt loams, 1 to 8 percent slopes. These very deep, nearly level and gently sloping soils are on broad plains. The moderately well drained Froberg soil is on low knolls. The somewhat poorly drained Rudyard soil is in slight depressions and drainageways. Individual areas of these soils are irregular in shape and range from 5 to 200 acres in size. They are 50 to 65 percent Froberg soil and 25 to 40 percent Rudyard soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Froberg soil has a surface layer of reddish brown silt loam about 6 inches thick. The subsoil is about 26 inches thick. The upper part is reddish brown, firm silty clay and silty clay loam; the next part is reddish brown, very firm silty clay; and the lower part is reddish brown, mottled, very firm silty clay. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places it is silty clay loam, stratified silt loam, or loamy very fine sand.

Typically, the Rudyard soil has a surface layer of dark reddish brown silt loam about 4 inches thick. The subsurface layer is reddish gray, mottled silt loam about 5 inches thick. The subsoil is clay about 15 inches thick. The upper part is dark reddish brown, mottled,

and firm, and the lower part is reddish brown, mottled, and very firm. The substratum to a depth of about 60 inches is reddish brown clay.

Included with these soils in mapping are small areas of the moderately well drained Munising and poorly drained Bergland soils. Munising soils are more droughty than the Froberg and Rudyard soils. They are in landscape positions similar to those of the Froberg soil. Bergland soils are in the lowest depressions. Included soils make up 5 to 10 percent of the unit.

Permeability is very slow in the upper part of the Froberg soil and moderate or moderately slow in the lower part. It is very slow in the Rudyard soil. The available water capacity is moderate in both soils. In spring and in other excessively wet periods, the Froberg soil has a seasonal high water table at a depth of 3 to 6 feet and the Rudyard soil has a perched high water table at a depth of 0.5 foot to 1.5 feet. Runoff is slow in wooded areas and moderate in cultivated areas.

Most areas are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is limited in spring and in other excessively wet periods because of the sticky and plastic qualities of the subsoil. Ruts form easily if wheeled skidders are used during these periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. When the soils are wet, unsurfaced roads and landings are slippery and ruts form easily. Year-round logging roads should be graveled.

Because of the seasonal high water table and the firm subsoil, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Some areas are used as cropland. These soils are fairly well suited to cultivated crops. The major management concerns are water erosion, the organic matter content, and deterioration of tilth. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Working the soils when they are wet results in compaction and the formation of clods. Returning crop residue to the soils, applying a system of conservation tillage, and adding organic material improve tilth and increase the content of organic matter.

Some areas are used as pasture or hayland. These soils are well suited to these uses. Preventing excessive compaction is the major management concern. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Froberg soil is 3C, and that assigned to the Rudyard soil is 6W. The land capability classification of both soils is IIIe. The Michigan soil management groups are 1a and Ob. The primary habitat type is TTL, and the secondary habitat type is TTP.

75A—Croswell-Au Gres sands, 0 to 3 percent slopes. These soils are very deep and nearly level. The moderately well drained Croswell soil is on low ridges, and the somewhat poorly drained Au Gres soil is in the intervening swales. Individual areas are linear in shape and range from 20 to 160 acres in size. They are 45 to 75 percent Croswell soil and 20 to 45 percent Au Gres soil. The two soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Croswell soil has a surface layer of very dark gray sand about 1 inch thick. The subsurface layer is light gray and pinkish gray sand about 15 inches thick. The subsoil is brown and reddish yellow, loose sand about 15 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is reddish yellow, mottled sand.

Typically, the Au Gres soil has a surface layer of black, well decomposed forest litter on the surface. The surface layer is light brownish gray, mottled sand about 19 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, loose sand about 20 inches thick. The substratum to a depth of about 60 inches is brown sand. In places it is loamy.

Included with these soils in mapping are small areas of the poorly drained Kinross and Roscommon soils in depressions. Also included are small areas of the excessively drained Deer Park soils in the higher landscape positions. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Croswell and Au Gres soils. In spring and in other excessively wet periods, the Croswell soil has a seasonal high water table at a depth of 2 to 4 feet and the Au Gres soil has one at a depth

of 0.5 foot to 1.5 feet. The available water capacity is low in both soils. Runoff is very slow.

These soils are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The seasonal wetness is a limitation in the lower areas. Equipment can be used only when the soils are relatively dry or have an adequate snow cover or when the roads and landings are sufficiently frozen. In the higher positions loose sand in heavily traveled areas can interfere with the traction of wheeled equipment during dry periods. Because of the seasonal high water table, trees are shallow rooted. They may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of seasonal droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate. After the trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Before trees are planted, site preparation by mechanical or chemical means generally is needed to control the undesirable plants.

The woodland ordination symbol assigned to the Croswell soil is 5S, and that assigned to the Au Gres soil is 6W. The land capability classification of both soils is IVw. The Michigan soil management groups are 5a and 5b. The primary habitat type is QAE, and the secondary habitat type is TMC-Vac.

76A—Au Gres-Kinross complex, 0 to 3 percent slopes. These very deep, nearly level soils are on broad plains. The somewhat poorly drained Au Gres soil is on low knolls. The poorly drained Kinross soil is in depressions. It is subject to ponding. Individual areas of these soils are irregular in shape and range from 10 to 200 acres in size. They are 35 to 70 percent Au Gres soil and 20 to 50 percent Kinross soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Au Gres soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light brownish gray, mottled sand about 19 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, loose sand about 20 inches thick. The substratum to a depth of about 60 inches is brown sand. In places it is loamy.

Typically, the Kinross soil has a surface layer of black muck about 3 inches thick. The subsurface layer is pinkish gray sand about 6 inches thick. The subsoil is sand about 40 inches thick. The upper part is brown and dark reddish brown, mottled, and very friable, and the lower part is reddish brown and loose. The substratum to a depth of about 60 inches is brown sand.

Included with these soils in mapping are small areas of the very poorly drained Dawson soils in the slightly lower positions on the landscape. Also included are small areas of the moderately well drained Croswell soils. They are in landscape positions slightly higher than those of the Au Gres soil. Included soils make up about 5 to 15 percent of the unit.

Permeability is rapid in the Au Gres and Kinross soils. The available water capacity is low. In spring and in other excessively wet periods, the seasonal high water table is near or above the surface of the Kinross soil and is at a depth of 0.5 foot to 1.5 feet in the Au Gres soil.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soils are usually wet from fall to spring and can be wet during other periods. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. Because of the wetness, the number of suitable landing sites is severely limited.

Seedling losses can be as high as 25 to 50 percent on the Au Gres soil because of droughtiness and more than 50 percent on the Kinross soil because of wetness. Trees generally are not planted on the Kinross soil because of the wetness and plant competition. In areas of the Au Gres soil, planting when the soil is moist and selecting special nursery stock for planting can reduce the seedling mortality rate. Because of the seasonal high water table, trees on these soils are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Before trees are planted on the Au Gres soil, site preparation by mechanical or chemical means generally is needed to control plant competition.

The woodland ordination symbol assigned to the Au Gres soil is 6W, and that assigned to the Kinross soil is 2W. The land capability classification of both soils is VIw. The Michigan soil management groups are 5b and 5c-a. The primary habitat type is TMC-Vac, and the secondary habitat type is PCS.

77—Tawas-Roscommon mucks. These very deep, nearly level soils are in depressions and drainageways. They are subject to ponding. The Tawas soil is very poorly drained, and the Roscommon soil is poorly drained. Individual areas are irregular in shape and range from 10 to 320 acres in size. They are 40 to 75 percent Tawas soil and 30 to 50 percent Roscommon soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Tawas soil has a surface layer of dark reddish brown muck about 4 inches thick. The next 16 inches is very dark gray and black muck. The substratum to a depth of about 60 inches is brown fine sand. In places it is loamy.

Typically, the Roscommon soil has a surface layer of black muck and mucky sand about 6 inches thick. The substratum to a depth of about 60 inches is light brownish gray and pale brown sand. In places the lower part of the substratum is loamy.

Included with these soils in mapping are small areas of the somewhat poorly drained Au Gres soils. These included soils are in slightly elevated areas near the edges of the depressions. They make up 5 to 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the mucky layers of the Tawas soil and rapid in the substratum. It is rapid in the Roscommon soil. The seasonal high water table is near or above the surface of both soils in spring and in other excessively wet periods. Runoff is very slow or ponded. The available water capacity is high in the Tawas soil and low in the Roscommon soil.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on these mucky soils. Special harvesting equipment is needed. Access is easiest during periods in winter when access roads are frozen. The number of suitable landing sites is severely limited because of the wetness.

Because of the wetness and the organic surface layer, seedling losses can be more than 50 percent. Because of the wetness, trees on these soils are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Trees generally are not planted on these soils because of the wetness, seedling mortality, and plant competition.

The woodland ordination symbol assigned to the Tawas soil is 5W, and that assigned to the Roscommon soil is 6W. The land capability classification of both soils is VIw. The Michigan soil management groups are M/4c and 5c. The primary habitat type is TTS, and the secondary habitat type is FI.

78B—Deer Park sand, 0 to 8 percent slopes. This very deep, nearly level and undulating, excessively drained soil is on beaches and dunes. Individual areas are irregular in shape and range from 25 to 230 acres in size.

Typically, about 2 inches of black, partially decomposed leaf litter is on the surface. The surface layer is black sand about 4 inches thick. The subsurface layer is pale brown sand about 20 inches thick. The subsoil is brown and yellowish brown, loose sand about 12 inches thick. The substratum to a depth of about 60 inches is pale brown sand. In places it is gravelly sand.

Included with this soil in mapping are small areas of the moderately well drained Croswell and somewhat poorly drained Au Gres soils in depressions and swales. These soils make up about 5 percent of the unit.

Permeability is rapid in the Deer Park soil. The available water capacity is low. Runoff is very slow.

Most areas are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

The woodland ordination symbol is 4S. The land capability classification is VIIs. The Michigan soil management group is 5.3a. The primary habitat type is QAE, and the secondary habitat type is AQVac.

79B—Yalmer-Assinins sands, 0 to 8 percent slopes. These very deep soils are on broad plains. The nearly level and undulating, moderately well drained Yalmer soil is on low knolls. The nearly level, somewhat poorly drained Assinins soil is in depressions and waterways. Individual areas of these soils are irregular in shape and range from 10 to 600 acres in size. They are 40 to 65 percent Yalmer soil and 20 to 50 percent

Assinins soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Yalmer soil has about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray sand about 9 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is dark reddish brown, reddish brown, and yellowish red, very friable sand; light reddish brown and reddish brown, firm loamy sand; reddish brown and light reddish brown, mottled, firm, mixed fine sandy loam and loamy sand; and reddish brown, firm fine sandy loam. The substratum to a depth of about 60 inches is reddish brown fine sandy loam. In places depth to the loamy subsoil is less than 20 inches or more than 40 inches.

Typically, the Assinins soil has about 3 inches of black, well decomposed leaf litter on the surface. The surface layer is very dark gray sand about 1 inch thick. The subsurface layer is pinkish gray sand about 13 inches thick. The subsoil is about 31 inches thick. The upper part is dark reddish brown, reddish brown, and brown, mottled, very friable sand, and the lower part is reddish brown, mottled, firm, mixed sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown fine sandy loam. In places depth to the loamy subsoil is less than 20 inches or more than 40 inches.

Included with these soils in mapping are small areas of the poorly drained Gay and Roscommon soils in the lowest positions on the landscape. These included soils make up about 5 to 10 percent of the unit.

Permeability is rapid in the upper part of the Yalmer soil, very slow in the next part, and moderate in the lower part. It is rapid in the upper part of the Assinins soil, moderately slow or moderate in the next part, and moderate in the lower part. In spring and in other excessively wet periods, the Yalmer soil has a seasonal high water table at a depth of 1.5 to 2.0 feet and the Assinins soil has one at a depth of 0.5 to 1.0 foot. Runoff is slow on both soils. The available water capacity is low.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted in late fall, in spring, and in other excessively wet periods. In some areas ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts restrict lateral drainage, expose tree roots, and alter soil structure. Loose sand can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads in areas of the Assinins soil should be stabilized. Culverts are needed to maintain the natural drainage system. The best sites for landings are in areas of the Yalmer soil.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Timely planting and selection of special planting stock can reduce these losses. Because of the seasonal high water table and the firm layer in the subsoil, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Yalmer soil is 3D, and that assigned to the Assinins soil is 3W. The land capability classification of both soils is IIIs. The Michigan soil management groups are 4a-af and 4b. The primary habitat type is ATD, and the secondary habitat type is TMC.

83—Udipsamments and Udorthents, nearly level. These soils are in areas that have been covered with fill. In some areas the upper 1 or 2 feet of the original soil material has been removed for use as topsoil. The texture ranges from sand to clay loam. In most areas the soils are somewhat excessively drained to moderately well drained, but in some areas they are somewhat poorly drained or poorly drained. Many of these areas are old copper mill sites and contain numerous foundations and abandoned railroad grades. These areas commonly include stamp sand, waste rock, dredgings, or ashes. A few areas consist of mineral soil material over muck. Some areas are used as landfills. Some are partially revegetated with brush and trees. Individual areas are irregular or linear in shape and range from 10 to 400 acres in size.

Most of the acreage is idle land. Some areas are suited to residential or industrial development, recreation uses, and wildlife habitat. Soil properties vary. Onsite investigation is needed to determine specific properties.

No interpretive groups are assigned to this unit.

84B—Graveraet loam, dissected, 1 to 12 percent slopes. This very deep, nearly level to moderately sloping, moderately well drained soil is in dissected areas on uplands where mainly parallel ravines are 50

to 300 feet apart. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas are irregularly shaped or elongated and range from 10 to 600 acres in size.

Typically, the surface layer is black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, mottled, firm fine sandy loam and reddish brown, mottled, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In some places the upper part of the subsoil is sandy. In other places sandstone bedrock is within a depth of 40 inches.

Included with this soil in mapping are areas of somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. The ravines have moderately steep to very steep side slopes. Also included are small areas of the somewhat excessively drained Kalkaska soils in landscape positions similar to those of the Graveraet soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. A perched seasonal high water table is at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is medium on the sides of the ravines and slow between the ravines. The available water capacity is low.

This soil is used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In these areas, however, the use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soil is dry or has an adequate snow cover. On year-round logging roads, a gravel base is needed. If the side slopes of the ravines are disturbed, erosion is a moderate hazard. As a result, logging roads and skid trails should be established in the less sloping areas between the ravines or should be built diagonally across the side slopes. Suitable sites for landings are between the ravines in the gently sloping areas.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3W. The land capability classification is IIIe. The Michigan soil management group is 2.5a-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

84D—Graveraet loam, dissected, 8 to 35 percent slopes. This very deep, moderately sloping to steep, well drained soil is on dissected uplands. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The ravines are dominantly parallel. They are 10 to 35 feet deep and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of this soil are irregular in shape and range from 5 to 220 acres in size.

Typically, the surface layer is black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, firm fine sandy loam and reddish brown, firm loam. The substratum to a depth of about 60 inches is reddish brown loam.

Included with this soil in mapping are areas of somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are small areas of the somewhat excessively drained Kalkaska and excessively drained Waiska soils in landscape positions similar to those of the Graveraet soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. The available water capacity is low. Runoff is medium on the sides of the ravines and slow between the ravines.

This soil is used as woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. In some of these areas, however, the use of equipment is briefly

restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced logging roads are slippery and ruts form easily. Year-round logging roads should be graveled. The number of suitable landing sites is limited because of the slope and the ravines. A few of the gently sloping included areas can be used as sites for landings.

If the side slopes of the ravines are disturbed, erosion is a moderate hazard. It results from the concentration of runoff on skid trails, on logging roads, and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, in the ravine bottoms, or diagonally across the side slopes helps to control erosion. Seeding the roads, trails, and landings after the trees are logged also helps to control erosion.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management group is 2.5a-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

84E—Graveraet loam, dissected, 15 to 60 percent slopes. This very deep, moderately steep to very steep, well drained soil is on dissected uplands. Ridgetops are dominantly moderately steep or steep and are 15 to 100 feet wide. The ravines are dominantly parallel. They are 15 to 50 feet deep and 40 to 150 feet wide and have moderately steep to very steep side slopes. The ravine bottoms are 10 to 20 feet wide. Some have seasonal streams. Individual areas of this soil are irregular in shape and range from 5 to 360 acres in size.

Typically, the surface layer is black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, firm fine sandy loam and reddish brown, firm loam. The substratum to a depth of about 60 inches is reddish brown loam.

Included with this soil in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some areas where the ravine bottoms have exposures of bedrock. Also included are small areas of the excessively drained Kalkaska and Waiska soils in landscape positions similar to those of the Graveraet soil. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. The available water capacity is low. Runoff is medium on the sides of the ravines and slow between the ravines.

This soil is used as woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Access is easiest on the ridgetops and on the bottoms of the ravines. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced logging roads are slippery and ruts form easily. On year-round logging roads, a gravel base is needed. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails in the less sloping areas between the ravines, on the ridgetops, or diagonally across the side slopes and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of the firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep to very steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management group is 2.5a-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

86B—Trimountain cobbly fine sandy loam, 1 to 8 percent slopes. This very deep, nearly level and gently

sloping, moderately well drained soil is on broad plains and low knolls. Individual areas are irregular in shape and range from 5 to 800 acres in size.

Typically, about 1 inch of black, decomposed forest litter is on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, mottled, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, mottled, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand. In some places the surface layer is sandy. In other places bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Net soils in depressions and drainageways and scattered small areas of the well drained Liminga soils. Also included are small areas of Paavola soils, which have more sand and gravel in the surface layer and subsoil than the Trimountain soil. Also, they are in similar landscape positions. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. A perched seasonal high water table is at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low.

Most areas are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. The degree of saturation generally is higher on the lower part of the slopes. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soil is dry or has an adequate snow cover. On year-round logging roads, a gravel base is needed. The best sites for landings are the nearly level areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment.

Because of the seasonal high water table and the firm layer in the lower part of the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

This soil is well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIIe. The Michigan soil management group is 3a-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

86D—Trimountain cobbly fine sandy loam, 8 to 15 percent slopes. This very deep, gently rolling and rolling, moderately well drained soil is on knolls and low ridges. Individual areas are irregular in shape and range from 5 to 500 acres in size.

Typically, about 1 inch of black, decomposed forest litter is on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, mottled, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, mottled, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand. In some places the surface layer is sandy. In other places bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Net soils in depressions on benches and flats. Also included are scattered small

areas of the well drained Liminga soils and small areas of Paavola soils. Paavola soils have more sand and gravel in the surface layer and subsoil than the Trimountain soil. Also, they are in similar landscape positions. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. A perched seasonal high water table is at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is slow or medium. The available water capacity is low.

This soil is used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. The degree of saturation generally is higher on the lower part of the slopes. The lower slopes and areas of the included soils on small flats and benches remain wet for longer periods than the more sloping areas. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts can restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soil is dry or has an adequate snow cover. On all-weather logging roads, a gravel base is needed. The slope limits the number of suitable landing sites. Landings can be established in the small nearly level areas, if any are available, or in the nearly level adjacent areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment.

Because of the firm layer in the lower part of the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is fairly well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic matter increase the organic matter content and conserve moisture.

This soil is fairly well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soil is wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IVe. The Michigan soil management group is 3a-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

86E—Trimountain cobbly fine sandy loam, 15 to 35 percent slopes. This deep, hilly and steep, well drained soil is on hills and side slopes. Individual areas are irregular in shape and range from 5 to 250 acres in size.

Typically, about 1 inch of black, decomposed forest litter is on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand. In some places the surface layer is sandy. In other places bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of the somewhat excessively drained Kalkaska and Waiska soils. These soils are in landscape positions similar to those of the Trimountain soil. Also included are small areas of poorly drained mineral soils in depressions and drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. Runoff is medium. The available water capacity is low.

This soil is used as woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the slope. Special care is needed in laying out roads and landings and in

operating equipment. Logging roads can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The number of suitable landing sites is minimal. Landings can be established in small nearly level areas, if any are available, and in the nearly level adjacent areas. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Erosion results from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, building logging roads on the contour or on the gentler slopes, and seeding logging roads, skid trails, and landings after the trees are logged help to prevent excessive soil loss.

Because of the firm layer in the lower part of the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management group is 3a-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

89B—Trimountain-Paavola complex, 1 to 8 percent slopes. These very deep, nearly level and gently sloping, moderately well drained soils are on low knolls and broad plains. Individual areas are irregular in shape and range from 10 to 350 acres in size. They are 40 to 65 percent Trimountain soil and 30 to 55 percent Paavola soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, mottled, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, mottled, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, mottled, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and reddish brown, mottled, very firm gravelly sandy loam. The substratum to a depth of 70 inches is reddish brown, firm very gravelly sandy loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Net soils in depressions and drainageways. Also included are scattered small areas of the well drained Liminga and excessively drained Waiska soils in landscape positions similar to those of the Trimountain and Paavola soils. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. Both soils have a perched seasonal high water table at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low in the Trimountain soil and very low in the Paavola soil.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is limited in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. The best sites for landings are the nearly level areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. On year-round logging roads, a gravel base is needed.

Because of droughtiness, seedling losses can be as

high as 25 to 50 percent on the Paavola soil. Planting when the soils are moist can reduce these losses. Because of the very firm layer in the subsoil of both soils, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

These soils are fairly well suited to cropland. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soils, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture. In some areas pebbles and cobbles on the surface hinder seedbed preparation and harvesting. They can be removed by a rock picker and can be buried or stockpiled.

These soils are well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIIe. The Michigan soil management groups are 3a-af and Ga/3af. The primary habitat type is ATD, and the secondary habitat type is AVO.

89D—Trimountain-Paavola complex, 8 to 15 percent slopes. These very deep, gently rolling and rolling, moderately well drained soils are on knolls, ridges, and side slopes. Individual areas are irregular in shape and range from 10 to 250 acres in size. They are 40 to 65 percent Trimountain soil and 30 to 55 percent Paavola soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Net soils in depressions and drainageways. Also included are scattered small areas of the well drained Liminga and excessively drained Waiska soils in landscape positions similar to those of the Trimountain and Paavola soils. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. Both soils have a perched seasonal high water table at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low in the Trimountain soil and very low in the Paavola soil.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is limited in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. The degree of saturation generally is higher on the lower part of the slope. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry

or have an adequate snow cover. The slope limits the number of suitable landing sites. Landings can be established in small nearly level areas, if any are available, or in the nearly level adjacent areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. On year-round logging roads, a gravel base is needed.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Paavola soil. Planting when the soil is moist can reduce these losses. Because of the very firm layer in the subsoil of both soils, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3W. The land capability classification is IVe. The Michigan soil management groups are 3a-af and Ga/3af. The primary habitat type is ATD, and the secondary habitat type is AVO.

89E—Trimountain-Paavola complex, 15 to 35 percent slopes. These very deep, hilly and steep, well drained soils are on hills and side slopes. Individual areas are irregular in shape and range from 10 to 250 acres in size. They are 40 to 65 percent Trimountain soil and 30 to 55 percent Paavola soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Net soils in depressions and drainageways. Also included are scattered small areas of the well drained Liminga and excessively drained Waiska soils in landscape positions similar to those of the Trimountain and Paavola soils. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. Runoff is medium on both soils. The available water capacity is low in the Trimountain soil and very low in the Paavola soil.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the slope. Special care is needed in laying out roads and landings and in operating equipment. Logging roads can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The number of suitable landing sites is minimal. The landings can be established in small nearly level areas, if any are available, and in the nearly level adjacent areas. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soils are wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Erosion results from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, building logging roads on the contour or on the gentler slopes, and seeding logging roads, skid trails, and landings after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Paavola soil. Planting when the soils are moist can reduce these losses. Because of the very firm layer in the subsoil of both

soils, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 3a-af and Ga/3af. The primary habitat type is ATD, and the secondary habitat type is AVO.

90—Witbeck very stony muck. This very deep, nearly level, poorly drained soil is in depressions and drainageways. It is subject to ponding. Stones and small boulders are in the surface layer. They typically are 10 to 36 inches in diameter and are rounded or semirounded. Individual areas of this soil are irregularly shaped or elongated and range from 5 to 120 acres in size.

Typically, the surface layer is about 10 inches thick. The upper part is black very stony muck, and the lower part is dark brown very stony silt loam. The mottled subsoil is about 14 inches thick and is friable. The upper part is brown sandy loam, and the lower part is brown gravelly sandy loam. The substratum to a depth of about 60 inches is brown gravelly loamy sand. In places it is gravelly sand or sand.

Included with this soil in mapping are small areas of the moderately well drained Trimountain soils on knolls. Also included are small areas of the very poorly drained Cathro soils in the slightly lower landscape positions and the poorly drained Net soils on slight rises. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Witbeck soil and moderately rapid in the lower part. The seasonal high water table is near or above the surface in spring and in other excessively wet periods. Runoff is very slow or ponded. The available water capacity is low.

This soil is used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soil is usually wet from fall to spring and can be wet during other periods. Ruts form easily if wheeled skidders are used during these periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. The number of suitable landing sites is severely limited because of the wetness.

Because of the wetness, seedling losses can be more than 50 percent and trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Trees generally are not planted on this soil because of the wetness and plant competition.

The woodland ordination symbol is 3X. The land capability classification is VIIs. The Michigan soil management group is 3c. The primary habitat type is TMC, and the secondary habitat type is TTS.

92B—Arcadian-Michigamme-Rock outcrop complex, 1 to 8 percent slopes. This nearly level and undulating map unit occurs as areas of a shallow, well drained Arcadian soil; a moderately deep, moderately well drained Michigamme soil; and intermingled areas of Rock outcrop. The unit is on broad plains, low knolls, and ridgetops. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are 30 to 50 percent Arcadian soil, 30 to 45 percent Michigamme soil, and 10 to 25 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Arcadian soil has a surface layer of dark brown very cobbly fine sandy loam about 5 inches thick. The subsoil is dark reddish brown, very friable very gravelly fine sandy loam about 13 inches thick. Bedrock is at a depth of about 18 inches. In places the depth to bedrock is less than 10 inches.

Typically, the Michigamme soil has a surface layer of dark reddish brown cobbly fine sandy loam about 3 inches thick. The subsurface layer is reddish brown cobbly fine sandy loam about 1 inch thick. The subsoil is about 25 inches thick. The upper part is dark reddish brown, friable fine sandy loam, and the lower part is

reddish brown, mottled, firm cobbly sandy loam. Bedrock is at a depth of about 29 inches. In places the depth to bedrock is more than 40 inches.

Included in this unit in mapping are small areas of the deep, moderately well drained Paavola and Trimountain soils and the excessively drained Waiska soils. These soils are in landscape positions similar to those of the Arcadian and Michigamme soils. Also included are small areas of somewhat poorly drained, loamy soils in depressions and drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Arcadian and Michigamme soils. In spring and in other excessively wet periods, the Michigamme soil has a perched seasonal high water table at a depth of 1 to 2 feet. The available water capacity is very low in the Arcadian soil and low in the Michigamme soil. Runoff is slow on both soils.

This unit is used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. On year-round logging roads, a gravel base is needed. The bedrock and the Rock outcrop can hinder road construction. Also, the Rock outcrop can hinder harvesting. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Because of the depth to bedrock, the trees are shallow rooted. Many may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Trees generally are not planted on these soils because of the shallowness to bedrock and the content of coarse fragments. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants.

The woodland ordination symbol assigned to the Arcadian soil is 3D, and that assigned to the Michigamme soil is 3W. The land capability classification of both soils is VIIs. The Michigan soil management groups are Ra and 3/Ra. The primary habitat type is AVO, and the secondary habitat type is ATD.

92D—Arcadian-Michigamme-Rock outcrop complex, 8 to 15 percent slopes. This gently rolling and rolling map unit occurs as areas of a shallow, well drained Arcadian soil; a moderately deep, moderately well drained Michigamme soil; and intermingled areas of Rock outcrop. The unit is on knolls, ridges, and side slopes. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are 35 to 50 percent Arcadian soil, 25 to 40 percent Michigamme soil, and 10 to 25 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Arcadian soil has a surface layer of dark brown very cobbly fine sandy loam about 5 inches thick. The subsoil is dark reddish brown, very friable very gravelly fine sandy loam about 13 inches thick. Bedrock is at a depth of about 18 inches. In places the depth to bedrock is less than 10 inches.

Typically, the Michigamme soil has a surface layer of dark reddish brown cobbly fine sandy loam about 3 inches thick. The subsurface layer is reddish brown cobbly fine sandy loam about 1 inch thick. The subsoil is about 25 inches thick. The upper part is dark reddish brown, friable fine sandy loam, and the lower part is reddish brown, mottled, firm cobbly sandy loam. Bedrock is at a depth of about 29 inches. In places the depth to bedrock is more than 40 inches.

Included in this unit in mapping are small areas of the deep, moderately well drained Paavola and Trimountain soils and the excessively drained Waiska soils. These soils are in landscape positions similar to those of the Arcadian and Michigamme soils. Also included are small areas of somewhat poorly drained, loamy soils in depressions and drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Arcadian and Michigamme soils. In spring and in other excessively wet periods, the Michigamme soil has a perched seasonal high water table at a depth of 1 to 2 feet. The available water capacity is very low in the Arcadian soil and low in the Michigamme soil. Runoff is slow on both soils.

This unit is used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate

snow cover. On year-round logging roads, a gravel base is needed. The bedrock and the Rock outcrop can hinder road construction. Also, the Rock outcrop can hinder harvesting. Landings can be established in small nearly level areas, if any are available.

Because of droughtiness, seedling losses can exceed 50 percent. Because of the depth to bedrock, the trees are shallow rooted. Many may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Trees generally are not planted on these soils because of the shallowness to bedrock and the content of coarse fragments. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants.

The woodland ordination symbol assigned to the Arcadian soil is 3D, and that assigned to the Michigamme soil is 3W. The land capability classification of both soils is VIIs. The Michigan soil management groups are Ra and 3/Ra. The primary habitat type is AVO, and the secondary habitat type is ATD.

92E—Arcadian-Michigamme-Rock outcrop complex, 15 to 35 percent slopes. This hilly and steep map unit occurs as areas of a shallow, well drained Arcadian soil; a moderately deep, well drained Michigamme soil; and intermingled areas of Rock outcrop. The unit is on hills, ridges, and side slopes. Individual areas are elongated or irregular in shape and range from 5 to 200 acres in size. They are 35 to 65 percent Arcadian soil, 20 to 40 percent Michigamme soil, and 10 to 35 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Arcadian soil has a surface layer of dark brown very cobbly fine sandy loam about 5 inches thick. The subsoil is dark reddish brown, very friable very gravelly fine sandy loam about 13 inches thick. Bedrock is at a depth of about 18 inches. In places the depth to bedrock is less than 10 inches.

Typically, the Michigamme soil has a surface layer of dark reddish brown cobbly fine sandy loam about 3 inches thick. The subsurface layer is reddish brown cobbly fine sandy loam about 1 inch thick. The subsoil is about 25 inches thick. The upper part is dark reddish brown, friable fine sandy loam, and the lower part is reddish brown, firm cobbly sandy loam. Bedrock is at a depth of about 29 inches. In places the depth to bedrock is more than 40 inches.

Included in this unit in mapping are small areas of the deep, moderately well drained Paavola and Trimountain soils. These soils are in landscape positions similar to those of the Arcadian and Michigamme soils. Also included are small areas where the Rock outcrop is very steep. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Arcadian and Michigamme soils. The available water capacity is very low in the Arcadian soil and low in the Michigamme soil. Runoff is medium on both soils.

This unit is used as woodland. The major management concerns are the equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted by the slope and the Rock outcrop. Special care is needed in laying out logging roads and landings and in operating equipment. The roads can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The bedrock and the Rock outcrop can hinder road construction. Also, the Rock outcrop can hinder harvesting. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soils are wet, unsurfaced roads tend to be slippery and ruts form easily. Year-round logging roads should be graveled. Landings can be established in small nearly level areas, if any are available, and in the nearly level adjacent areas.

Erosion results from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, building logging roads on the contour or on the gentler slopes, and seeding the roads, trails, and landings after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Because of the depth to bedrock, the trees are shallow rooted. Many may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Trees generally are not planted on these soils because of the shallowness to bedrock and the content of coarse fragments. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management groups are Ra and 3/Ra. The primary habitat type is AVO, and the secondary habitat type is ATD.

95A—Assinins-Skanee complex, 0 to 3 percent slopes. These very deep, nearly level, somewhat poorly drained soils are on broad flats and in depressions and drainageways. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are 30 to 60 percent Assinins soil and 25 to 55 percent Skanee soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Assinins soil has about 3 inches of black, well decomposed leaf litter on the surface. The surface layer is very dark gray sand about 1 inch thick. The subsurface layer is pinkish gray sand about 13 inches thick. The subsoil is about 31 inches thick. The upper part is dark reddish brown, reddish brown, and brown, mottled, very friable sand, and the lower part is reddish brown, mottled, firm, mixed sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown fine sandy loam. In places depth to the loamy subsoil is more than 40 inches.

Typically, the Skanee soil has about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray, mottled fine sandy loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is dark reddish brown, mottled, friable fine sandy loam; the next part is reddish brown, mottled, firm fine sandy loam; and the lower part is reddish brown, friable sandy clay loam. The substratum to a depth of about 60 inches is reddish brown sandy loam.

Included with these soils in mapping are scattered small areas of the well drained Liminga soils and the moderately well drained Munising and Yalmer soils on low knolls and ridges. Also included are scattered small areas of the poorly drained Gay soils in the lower positions on the landscape. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the upper part of the Assinins soil, moderate or moderately slow in the next part, and moderate in the lower part. It is very slow in the firm part of the subsoil in the Skanee soil and moderate in the rest of the profile. Both soils have a seasonal high water table at a depth of 0.5 foot to 1.5 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in late fall, in spring, and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in areas of the Assinins soil can interfere with the traction of wheeled equipment during dry periods. Year-round logging roads should be graveled. Culverts are needed to maintain the natural drainage system. The number of suitable landing sites is minimal. The areas of included Munising and Yalmer soils are possible sites for landings.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Because of the firm layer in the lower part of the subsoil and the seasonal high water table, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3W. The land capability classification is IIIw. The Michigan soil management groups are 4b and 3b-af. The primary habitat type is TMC.

96B—Liminga fine sand, 0 to 8 percent slopes. This very deep, nearly level and gently sloping, well drained soil is on knolls and broad plains. Individual areas are irregular in shape and range from 10 to 500 acres in size.

Typically, about 1 inch of black, well decomposed forest litter is on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches

thick. The substratum to a depth of about 60 inches is reddish yellow fine sand. In places the soil is sand throughout.

Included with this soil in mapping are small areas of the moderately well drained Yalmer soils. These soils have a perched seasonal high water table. They are in landscape positions similar to those of the Liminga soil. Also included are small areas of the somewhat poorly drained Au Gres soils in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Liminga soil. The available water capacity is low. Runoff is slow.

This soil is used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is fairly well suited to cropland. The major management concerns are water erosion, wind erosion, droughtiness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Contour stripcropping, buffer strips, and field windbreaks reduce the hazard of wind erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

This soil is well suited to pasture and hay. The major management concern is the low available water capacity. Proper stocking rates, rotation grazing, and restricted grazing during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3S. The land capability classification is IIIs. The Michigan soil management group is 4a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

96D—Liminga fine sand, 8 to 15 percent slopes. This very deep, gently rolling and rolling, well drained soil is on knolls, side slopes, and broad plains. Individual areas are irregular in shape and range from 5 to 200 acres in size.

Typically, about 1 inch of black, well decomposed forest litter is on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand. In places the soil is sand throughout.

Included with this soil in mapping are small areas of the moderately well drained Yalmer soils. These soils have a perched seasonal high water table. They are in landscape positions similar to those of the Liminga soil. Also included are small areas of the somewhat poorly drained Au Gres soils in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Liminga soil. The available water capacity is low. Runoff is slow.

This soil is used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Landings can be established in small nearly level areas, if any are available.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is fairly well suited to cropland. The major management concerns are water erosion, wind erosion, droughtiness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soil, applying a system of conservation tillage, and adding organic material

increase the organic matter content and conserve moisture.

This soil is well suited to pasture and hay. The major management concern is the low available water capacity. Proper stocking rates, rotation grazing, and restricted grazing during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3S. The land capability classification is IIIe. The Michigan soil management group is 4a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

96E—Liminga fine sand, 15 to 35 percent slopes. This very deep, hilly and steep, well drained soil is on hills and side slopes. Individual areas are irregular in shape and range from 5 to 150 acres in size.

Typically, about 1 inch of black, well decomposed forest litter is on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand. In places the soil is sand throughout.

Included with this soil in mapping are small areas of the moderately well drained Munising soils. These soils have a perched seasonal high water table. They are in landscape positions similar to those of the Liminga soil. Also included are small areas of the somewhat poorly drained Au Gres soils in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Liminga soil. The available water capacity is low. Runoff is slow.

This soil is used as woodland. The equipment limitation, the erosion hazard, seedling mortality, and plant competition are management concerns. The slope and loose sand can interfere with the traction of wheeled equipment. The slope limits the number of suitable sites for logging roads and landings. Logging roads and skid trails can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. Landings can be established in small nearly level areas, if any are available. Erosion can result from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures helps to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed. The slope hinders site preparation and tree planting.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management group is 4a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

96F—Liminga fine sand, 35 to 70 percent slopes. This very deep, very steep, well drained soil is on side slopes. Individual areas are irregularly shaped or elongated and range from 20 to 200 acres in size.

Typically, about 1 inch of black, well decomposed forest litter is on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand. In places the soil is sand throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Au Gres and poorly drained Roscommon soils in depressions and drainageways. Also included are small areas of Munising soils. Munising soils are loamy throughout and are in landscape positions similar to those of the Liminga soil. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Liminga soil. The available water capacity is low. Runoff is slow.

This soil is used as woodland. The equipment limitation, the erosion hazard, seedling mortality, and plant competition are management concerns. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Special logging methods, such as yarding the logs with a cable, may be needed. The loose sand and the slope can interfere with the traction of wheeled equipment. Because of the erosion hazard, logging roads and skid trails should be built on the contour and water should be removed with water bars, out-sloping or in-sloping road surfaces,

culverts, and drop structures. Because of droughtiness, seedling losses can be as high as 25 to 50 percent, especially on southern exposures.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed. The slope seriously hinders site preparation and tree planting.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management group is 4a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

98B—Munising-Yalmer complex, dissected, 1 to 12 percent slopes. These very deep, nearly level to moderately sloping, moderately well drained soils are on dissected uplands that have parallel ravines 50 to 300 feet apart. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are elongated or irregularly shaped and range from 5 to 500 acres in size. They are 50 to 65 percent Munising soil and 20 to 40 percent Yalmer soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places sandstone bedrock is at a depth of 20 to 40 inches.

Typically, the Yalmer soil has about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray sand about 9 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is dark reddish brown, reddish brown, and yellowish red, very friable sand; light reddish brown and reddish brown, firm loamy sand; reddish brown and light reddish brown, mottled, firm, mixed fine sandy loam and loamy sand; and reddish brown, firm fine sandy loam. The substratum to a depth of about 60 inches is reddish brown fine sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. The ravines have moderately steep to very steep side slopes. Also included are small areas of the somewhat excessively drained Kalkaska soils in landscape positions similar to those of the Munising and Yalmer soils and areas where the ravine bottoms have exposures of bedrock. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is rapid in the sandy upper part of the Yalmer soil, very slow in the next part, and moderate in the lower part. In spring and in other excessively wet periods, the Munising soil has a perched seasonal high water table at a depth of 1 to 2 feet and the Yalmer soil has one at a depth of 1.5 to 2.0 feet. The available water capacity is low. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In these areas, however, the use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in areas of the Yalmer soil can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. The erosion hazard is moderate if the side slopes of the ravines are disturbed. Building logging roads and skid trails in the less sloping areas between the ravines or diagonally across the side slopes helps to prevent excessive soil loss. The best sites for landings are the nearly level areas between the ravines.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Yalmer soil. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the firm layer in the subsoil, the trees on these soils are shallow rooted. Some may be blown down during periods of high wind

and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

These soils are fairly well suited to crops. The major management concerns are water erosion, seasonal wetness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soils, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

These soils are well suited to pasture and hay. The major management concerns are the seasonal high water table, the low available water capacity, and compaction. Grassed waterways help to remove surface water. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Munising soil is 3W, and that assigned to the Yalmer soil is 3D. The land capability classification of both soils is IIIe. The Michigan soil management groups are 3a-af and 4a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

98D—Munising-Yalmer complex, dissected, 8 to 35 percent slopes. These very deep, moderately sloping to steep, well drained soils are on dissected uplands. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The ravines are dominantly parallel, 10 to 35 feet deep, and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are elongated or irregularly shaped and range from 5 to 250 acres in size. They are 50 to 65 percent Munising soil and 20 to 40 percent Yalmer soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places sandstone bedrock is at a depth of 20 to 40 inches.

Typically, the Yalmer soil has about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray sand about 9 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is dark reddish brown, reddish brown, and yellowish red, very friable sand; light reddish brown and reddish brown, firm loamy sand; reddish brown and light reddish brown, firm, mixed fine sandy loam and loamy sand; and reddish brown, firm fine sandy loam. The substratum to a depth of about 60 inches is reddish brown fine sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and small areas of the somewhat excessively drained Kalkaska soils in landscape positions similar to those of the Munising and Yalmer soils. Also included are areas where the ravine bottoms have exposures of bedrock. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is rapid in the sandy upper part of the Yalmer soil, very slow in the next part, and moderate in the lower part. The available water capacity is low in both soils. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland (fig. 11). The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. In some of these areas, however, the use of equipment is briefly restricted in spring and in other excessively wet periods. When the soils are wet, unsurfaced roads tend to be slippery and ruts form easily. Loose sand in areas of the Yalmer soil can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. The number of suitable landing sites is limited because of the slope and the ravines. A few gently sloping areas may be available for use as landing sites.

On the side slopes of the ravines, erosion is a moderate hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks

Figure 11.—Northern hardwoods in an area of Munising-Yalmer complex, dissected, 8 to 35 percent slopes.

of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding the roads after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Yalmer soil. Because of the firm layer in the subsoil, the trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management groups are 3a-af and 4a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

98E—Munising-Yalmer complex, dissected, 15 to 60 percent slopes. These very deep, moderately steep to very steep, well drained soils are on dissected uplands. Ridgetops are dominantly moderately steep or steep and are 15 to 100 feet wide. The ravines are dominantly parallel, 15 to 50 feet deep, and 40 to 150 feet wide and have moderately steep to very steep side slopes. The ravine bottoms are 10 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 360 acres in size. They are 40 to 60 percent Yalmer soil and 35 to 50 percent Munising soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places sandstone bedrock is at a depth of 20 to 40 inches.

Typically, the Yalmer soil has about 2 inches of black, well decomposed forest litter on the surface. The surface layer is pinkish gray sand about 9 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is dark reddish brown, reddish brown, and yellowish red, very friable sand; light reddish brown and reddish brown, firm loamy sand; reddish brown and light reddish brown, firm, mixed fine sandy loam and loamy sand; and reddish brown, firm fine sandy loam. The substratum to a depth of about 60 inches is reddish brown fine sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some areas where the ravine bottoms are stony or have exposures of bedrock. Also included are small areas of the somewhat excessively drained Kalkaska soils in landscape positions similar to those of the Munising and Yalmer soils. Included areas make up about 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is rapid in the upper part of the Yalmer soil, very slow in the next part, and moderate in

the lower part. The available water capacity is low in both soils. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Access is easiest on the ridgetops and on the ravine bottoms. The use of equipment is briefly limited in spring and in other excessively wet periods. When the Munising soil is wet, unsurfaced logging roads are slippery and ruts form easily. Loose sand in areas of the Yalmer soil can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Yalmer soil. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the firm layer in the subsoil, the trees are shallow rooted. Some may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep to very steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 3a-af and 4a-af. The primary habitat type is ATD, and the secondary habitat type is TM.

100A—Au Gres-Roscommon complex, 0 to 3 percent slopes. These very deep, nearly level soils are on broad plains. The somewhat poorly drained Au Gres soil is on low knolls. The poorly drained Roscommon soil is in depressions. It is subject to ponding. Individual areas of these soils are irregular in shape and range from 5 to 420 acres in size. They are 35 to 65 percent Au Gres soil and 20 to 55 percent Roscommon soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Au Gres soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light brownish gray, mottled sand about 19 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, loose sand about 20 inches thick. The substratum to a depth of about 60 inches is brown sand. In places it is loamy.

Typically, the Roscommon soil has a surface layer of black muck and mucky sand about 6 inches thick. The substratum to a depth of about 60 inches is light brownish gray and pale brown sand. In places the lower part of the substratum is loamy.

Included with these soils in mapping are small areas of the very poorly drained Tawas soils in the slightly lower positions on the landscape. Also included are small areas of the moderately well drained Halfaday soils. Halfaday soils are in the slightly higher positions on the landscape. Included soils make up about 5 to 10 percent of the unit.

Permeability is rapid in the Au Gres and Roscommon soils. The available water capacity is low. In spring and in other excessively wet periods, the seasonal high water table is near or above the surface of the Roscommon soil and is at a depth of 0.5 foot to 1.5 feet in the Au Gres soil.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. These soils are usually wet from fall to spring and can be wet during other periods. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. Because of the wetness, the number of suitable landing sites is severely limited.

Seedling losses can be as high as 25 to 50 percent on the Au Gres soil because of droughtiness and can be more than 50 percent on the Roscommon soil because of wetness. Trees generally are not planted on the Roscommon soil because of the wetness and plant competition. In areas of the Au Gres soil, planting when the soil is moist and selecting special nursery stock can reduce the seedling mortality rate. Because of the

seasonal high water table, trees on these soils are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. If trees are planted on the Au Gres soil, site preparation by mechanical or chemical means generally is needed to control plant competition.

The woodland ordination symbol is 6W. The land capability classification is VIw. The Michigan soil management groups are 5b and 5c. The primary habitat type is TMC, and the secondary habitat type is TTS.

101A—Net stony fine sandy loam, 0 to 3 percent slopes. This very deep, nearly level, somewhat poorly drained soil is in depressions and drainageways. Stones and small boulders are in the surface layer. They typically are 10 to 36 inches in diameter and are rounded or semirounded. Individual areas of this soil are irregularly shaped or elongated and range from 5 to 105 acres in size.

Typically, the surface layer is very dark brown stony fine sandy loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is dark reddish brown, friable fine sandy loam; the next part is reddish brown and dark reddish brown, mottled, firm fine sandy loam and gravelly fine sandy loam; and the lower part is reddish brown, mottled, friable gravelly loamy sand. The substratum to a depth of about 60 inches is reddish brown, mottled gravelly loamy sand. In places the subsoil is gravelly sand or sand.

Included with this soil in mapping are small areas of the moderately well drained Trimountain and poorly drained Witbeck soils. Trimountain soils are on low knolls. Witbeck soils are in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Net soil, very slow in the next part, and moderate or moderately rapid in the lower part. The perched seasonal high water table is at a depth of 0.5 foot to 1.5 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low.

This soil is used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in late fall, in spring, and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soil is dry or has an adequate snow cover. On year-round logging roads, roadfill and a gravel base are needed. Culverts are needed to maintain the natural drainage system. Landing sites are generally available only during the driest periods. The small areas of included Trimountain soils in the slightly higher landscape positions can be used as sites for landings. In some areas the landings should be stabilized, so that they can withstand the repeated use of heavy equipment. The large stones on the surface can reduce the operating speed of skidders and can damage equipment.

Because water is perched on the firm layer in the subsoil during wet periods, seedling losses can be as high as 25 to 50 percent. Timely planting and the selection of special nursery stock can reduce these losses. Because of the firm layer in the lower part of the subsoil and the seasonal high water table, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. If trees are planted, site preparation by mechanical or chemical means is needed to control plant competition.

The woodland ordination symbol is 3X. The land capability classification is VIIs. The Michigan soil management group is 3b-af. The primary habitat type is ATD-CI, and the secondary habitat type is TMC.

102A—Net-Witbeck complex, 0 to 3 percent slopes. These soils are very deep and nearly level. The somewhat poorly drained Net soil is on very low knolls and around the edges of the mapped areas. The poorly drained Witbeck soil is in depressions and drainageways and in the center of the mapped areas. It is subject to ponding. Stones and small boulders are in the surface layer of these soils. They typically are 10 to 36 inches in diameter and are rounded or semirounded. Individual areas of these soils are irregular in shape and range from 5 to 625 acres in size. They are 45 to 65 percent Net soil and 25 to 45 percent Witbeck soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Net soil has a surface layer of very dark brown stony fine sandy loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is dark reddish brown, friable fine sandy loam; the next

part is reddish brown and dark reddish brown, mottled, firm fine sandy loam and gravelly fine sandy loam; and the lower part is reddish brown, mottled, friable gravelly loamy sand. The substratum to a depth of about 60 inches is reddish brown, mottled gravelly loamy sand. In places the subsoil is gravelly sand or sand.

Typically, the Witbeck soil has a surface layer about 10 inches thick. The upper part is black very stony muck, and the lower part is dark brown very stony silt loam. The subsoil is about 14 inches thick. It is mottled and friable. The upper part is brown sandy loam, and the lower part is brown gravelly sandy loam. The substratum to a depth of about 60 inches is brown gravelly loamy sand. In places it is gravelly sand or sand.

Included with these soils in mapping are small areas of the moderately well drained Trimountain and Paavola soils on low knolls. These included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Net soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate in the upper part of the Witbeck soil and moderately slow to moderately rapid in the lower part. In spring and in other excessively wet periods, the Net soil has a seasonal high water table at a depth of 0.5 foot to 1.5 feet and the Witbeck soil has one near or above the surface. Runoff is slow or very slow on both soils. The available water capacity is low.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted in late fall, in spring, and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts can expose tree roots and alter soil structure. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. The large stones can reduce the operating speed of skidders and can damage equipment. The number of suitable landing sites is severely limited because of the wetness.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent on the Witbeck soil. Because of the firm layer in the subsoil and the wetness, trees on these soils are shallow rooted. Some may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Tree planting is severely limited by the wetness, the stoniness, and plant competition.

The woodland ordination symbol is 3X. The land capability classification is VIIs. The Michigan soil management groups are 3b-af and 3c. The primary habitat type is TMC, and the secondary habitat type is FI.

103B—Trimountain-Net complex, 0 to 8 percent slopes. These deep soils are on broad plains. The nearly level and undulating, moderately well drained Trimountain soil is on low knolls and ridges. The nearly level, somewhat poorly drained Net soil is on small flats and in slightly depressional areas. Stones and small boulders are on the surface. They typically are 10 to 36 inches in diameter and are 1 to 10 feet apart. They are rounded or semirounded. Individual areas of these soils are irregular in shape and range from 10 to 675 acres in size. They are 50 to 75 percent Trimountain soil and 20 to 45 percent Net soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand. In some places the surface layer is sandy. In other places bedrock is at a depth of 20 to 40 inches.

Typically, the Net soil has a surface layer of very dark brown stony fine sandy loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is dark reddish brown, friable fine sandy loam; the next part is reddish brown and dark reddish brown, mottled, firm fine sandy loam and gravelly fine sandy loam; and the lower part is reddish brown, mottled, friable gravelly loamy sand. The substratum to a depth of about 60 inches is reddish brown, mottled gravelly loamy sand. In places the subsoil is gravelly sand or sand.

Included with these soils in mapping are small areas of the poorly drained Witbeck soils in the lowest

depressions. Also included are small areas of the moderately well drained Paavola soils. Paavola soils are very gravelly loamy sand in the upper part of the subsoil. They are in landscape positions similar to those of the Trimountain soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Trimountain and Net soils, very slow in the next part, and moderate or moderately rapid in the lower part. In spring and in other excessively wet periods, the Trimountain soil has a perched seasonal high water table at a depth of 1 to 2 feet and the Net soil has one at a depth of 0.5 foot to 1.5 feet. The Net soil remains wet for longer periods than the Trimountain soil. Runoff is slow on both soils. The available water capacity is low.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Year-round logging roads should be graveled. Culverts are needed to maintain the natural drainage system. The large stones can reduce the operating speed of skidders and can damage equipment. The best sites for landings are areas of the Trimountain soil.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent on the Net soil. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Because of the firm layer in the lower part of the subsoil and the seasonal high water table, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Trimountain soil is 3W, and that assigned to the Net soil is 3X. The land capability classification of both soils is IVe. The Michigan soil management groups are 3a-af and 3b-af. The primary habitat type is ATD, and the secondary habitat type is TMC.

104D—Urban land-Udorthents complex, strongly sloping, rocky. This map unit consists of Urban land and strongly sloping, well drained and moderately well drained, loamy soils. Individual areas are irregular in shape and range from 10 to 240 acres in size. They are 50 to 80 percent Urban land, 10 to 40 percent Udorthents, and 1 to 10 percent rock outcrop. The Urban land and Udorthents occur as areas so intricately mixed or so small that mapping them separately was not practical.

The Urban land is covered by streets, parking lots, driveways, buildings, and other structures that so obscure or alter the soils that identification of the soil series is not feasible.

The Udorthents vary greatly in some important soil properties, especially content of coarse fragments and depth. The original soil material has been removed or has been covered with fill. The depth to bedrock ranges from 2 to more than 10 feet.

Included in this unit in mapping are small areas of well drained, sandy soils and shallow soils. Included soils make up 5 to 10 percent of the unit.

The Udorthents consist of lawns or empty lots. The erosion hazard is moderate in disturbed areas. Onsite investigation is necessary to determine the suitability for specific uses.

No interpretive groups are assigned to this unit.

106B—Urban land-Udorthents-Udipsamments complex, gently sloping. This map unit consists of Urban land; gently sloping, moderately well drained, loamy soils; and somewhat excessively drained, sandy soils. Individual areas are irregular in shape and range from 15 to 690 acres in size. They are 45 to 70 percent Urban land and 25 to 50 percent Udorthents and Udipsamments. The Urban land, Udorthents, and Udipsamments occur as areas so intricately mixed or so small that mapping them separately was not practical.

The Urban land is covered by streets, parking lots, driveways, buildings, and other structures that so obscure or alter the soils that identification of the soil series is not feasible.

The Udorthents and Udipsamments are used for lawns or recreational facilities or are in empty lots. The original soil material has been removed or has been covered with fill. The Udorthents vary considerably in some important soil properties, especially soil density

and permeability. In many areas permeability is slow in the upper part of the soil. The Udipsamments are dominantly sandy soils, but loamy material is on the surface in some areas, especially on lawns. In some areas the content of gravel and cobbles is 15 to 60 percent.

Included in this unit in mapping are small areas of somewhat poorly drained and poorly drained soils in depressions. Included soils make up less than 5 percent of the unit.

Onsite investigation is necessary to determine the suitability for specific uses.

No interpretive groups are assigned to this unit.

106D—Urban land-Udorthents-Udipsamments complex, strongly sloping. This map unit consists of Urban land; strongly sloping, well drained, loamy soils; and somewhat excessively drained, sandy soils. Individual areas are irregular in shape and range from 5 to 80 acres in size. They are 45 to 70 percent Urban land and 25 to 50 percent Udorthents and Udipsamments. The Urban land, Udorthents, and Udipsamments occur as areas so intricately mixed or so small that mapping them separately was not practical.

The Urban land is covered by streets, parking lots, driveways, buildings, and other structures that so obscure or alter the soils that identification of the soil series is not feasible.

The Udorthents and Udipsamments consist of lawns or empty lots. The original soil material has been removed or has been covered with fill. The Udorthents vary considerably in some important soil properties, especially soil density and permeability. In many areas permeability is slow in the upper part of the soil. The Udipsamments are dominantly sandy soils, but loamy material is on the surface in some areas, especially on lawns. In some areas the content of gravel and cobbles is 15 to 60 percent.

Included in this unit in mapping are small areas of somewhat poorly drained and poorly drained soils in depressions. Included soils make up less than 5 percent of the unit.

The erosion hazard is moderate in disturbed areas. Onsite investigation is necessary to determine the suitability for specific uses.

No interpretive groups are assigned to this unit.

106E—Urban land-Udorthents-Udipsamments complex, steep. This map unit consists of Urban land; steep, well drained, loamy soils; and somewhat excessively drained, sandy soils. Individual areas are irregular in shape and range from 25 to 60 acres in size. They are 45 to 50 percent Urban land, 15 to 20 percent Udorthents, and 15 to 20 percent Udipsamments. The Urban land, Udorthents, and Udipsamments occur as areas so intricately mixed or so small that mapping them separately was not practical.

The Urban land is covered by streets, parking lots, driveways, buildings, and other structures that so obscure or alter the soils that identification of the soil series is not feasible.

The Udorthents and Udipsamments consist of lawns or empty lots. The original soil material has been removed or has been covered with fill. The Udorthents vary considerably in some important soil properties, especially soil density and permeability. In many areas permeability is slow in the upper part of the soil. The Udipsamments are dominantly sandy soils, but loamy material is on the surface in some areas, especially on lawns. In some areas the content of gravel and cobbles is 15 to 60 percent.

Included in this unit in mapping are small areas of somewhat poorly drained and poorly drained soils in depressions. Also included are small areas of rock outcrop and a few areas of shallow soils. Included soils make up 5 to 10 percent of the unit.

The erosion hazard is moderate in disturbed areas. Onsite investigation is necessary to determine the suitability for specific uses.

No interpretive groups are assigned to this unit.

107B—Kalkaska-Waiska sands, 0 to 8 percent slopes. These very deep, nearly level and gently sloping soils are on knolls and broad plains. The Kalkaska soil is somewhat excessively drained, and the Waiska soil is excessively drained. Individual areas are irregular in shape and range from 5 to 900 acres in size. They are 45 to 65 percent Kalkaska soil and 25 to 50 percent Waiska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In places stratified, loamy or silty material is below a depth of 40 inches.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark

reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are small areas of the moderately well drained Yalmer soils. These included soils have a perched seasonal high water table. They are in landscape positions similar to those of the Kalkaska and Waiska soils. Also included are small areas of the poorly drained Roscommon soils in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Kalkaska soil and very rapid in the Waiska soil. The available water capacity is low in the Kalkaska soil and very low in the Waiska soil. Runoff is slow on both soils.

These soils are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

The woodland ordination symbol is 3S. The land capability classification is IVs. The Michigan soil management groups are 5a and Ga. The primary habitat type is ATD-D, and the secondary habitat type is TM.

107D—Kalkaska-Waiska sands, 8 to 15 percent slopes. These very deep, gently rolling and rolling soils are on knolls, side slopes, and broad plains. The Kalkaska soil is somewhat excessively drained, and the Waiska soil is excessively drained. Individual areas are irregular in shape and range from 5 to 295 acres in size. They are 40 to 65 percent Kalkaska soil and 25 to 50 percent Waiska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In places stratified, loamy or silty material is below a depth of 40 inches.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Permeability is rapid in the Kalkaska soil and very rapid in the Waiska soil. The available water capacity is low in the Kalkaska soil and very low in the Waiska soil. Runoff is slow on both soils.

These soils are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Landings can be established in small nearly level areas, if any are available.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

The woodland ordination symbol is 3S. The land capability classification is VIs. The Michigan soil management groups are 5a and Ga. The primary habitat type is ATD-D, and the secondary habitat type is TM.

107E—Kalkaska-Waiska sands, 15 to 35 percent slopes. These very deep, hilly and steep soils are on hills and side slopes. The Kalkaska soil is somewhat excessively drained, and the Waiska soil is excessively drained. Individual areas are irregular in shape and range from 5 to 440 acres in size. They are 40 to 65 percent Kalkaska soil and 25 to 50 percent Waiska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In places stratified, loamy or silty material is below a depth of 40 inches.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Permeability is rapid in the Kalkaska soil and very rapid in the Waiska soil. The available water capacity is low in the Kalkaska soil and very low in the Waiska soil. Runoff is slow on both soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, and seedling mortality are management concerns. The slope and the loose sand can interfere with the traction of wheeled equipment. The slope limits the number of suitable sites for logging roads and landings. The logging roads and skid trails can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The landings can be established in small nearly level areas, if any are available. Erosion can result from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures helps to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management groups are 5a and Ga. The primary habitat type is ATD-D, and the secondary habitat type is TM.

108B—Freda silt loam, 1 to 8 percent slopes. This shallow, nearly level and gently sloping, well drained soil is on bedrock benches near Lake Superior. Individual areas are irregular in shape and range from 10 to 560 acres in size.

Typically, about 1 inch of black, partially decomposed forest litter is on the surface. The surface layer is black silt loam about 1 inch thick. The subsurface layer is dark reddish gray silt loam about 3 inches thick. The subsoil is about 8 inches thick. The upper part is dark reddish brown, friable silt loam, and the lower part is dark reddish brown, friable channery silt loam. The substratum is highly weathered shale about 4 inches thick. Stratified, shale and sandstone bedrock is at a depth of about 16 inches. In places the depth to bedrock is more than 20 inches.

Included with this soil in mapping are small areas of the moderately deep, somewhat poorly drained Zeba and poorly drained Jacobsville soils. These soils are in depressions and drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Freda soil. The available water capacity is very low. Runoff is slow.

This soil is used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. Ruts form easily if skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Also, they can result in a change in species composition and can reduce yields. Equipment should be used only when the soil is dry or has an adequate snow cover. A gravel base is needed on year-round logging roads. The shallowness to bedrock can hinder road construction. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Because of the depth to bedrock, trees on this soil are shallow rooted. Many may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Trees are generally not planted on this soil because of the shallowness to bedrock. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants.

The woodland ordination symbol is 3D. The land capability classification is VIs. The Michigan soil management group is Ra. The primary habitat type is ATD, and the secondary habitat type is AVO.

110D—Kalkaska-Waiska sands, dissected, 8 to 35 percent slopes. These very deep, moderately sloping to steep soils are on dissected uplands. The Kalkaska soil is somewhat excessively drained, and the Waiska soil is excessively drained. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The ravines are dendritic or parallel, 10 to 35 feet deep, and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in

shape and range from 5 to 170 acres in size. They are 45 to 65 percent Kalkaska soil and 30 to 50 percent Waiska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In places loamy or silty material is below a depth of 40 inches.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are small areas of the well drained Munising soils. Munising soils have a firm layer in the lower part of the subsoil. They are in landscape positions similar to those of the Kalkaska and Waiska soils. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Kalkaska soil and very rapid in the Waiska soil. The available water capacity is low in the Kalkaska soil and very low in the Waiska soil. Runoff is slow on both soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, and seedling mortality are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. Loose sand can interfere with the traction of wheeled equipment, especially during dry periods. The number of suitable landing sites is very limited. Erosion is a moderate or severe hazard on the side slopes of the ravines. It results from the concentration of runoff on skid trails, on logging roads, and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes helps to control erosion. Seeding the roads, trails, and landings after the trees are logged also helps to control erosion. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting containerized seedlings or special nursery stock can reduce these losses.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management groups are 5a and Ga. The primary habitat type is ATD-D, and the secondary habitat type is AVO.

110E—Kalkaska-Waiska sands, dissected, 15 to 60 percent slopes. These very deep, moderately steep to very steep soils are on dissected uplands. The Kalkaska soil is somewhat excessively drained, and the Waiska soil is excessively drained. Ridgetops are dominantly moderately steep or steep and are 15 to 150 feet wide. The ravines are dendritic or parallel, 15 to 50 feet deep, and 40 to 150 feet wide and have moderately steep to very steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 180 acres in size. They are 40 to 60 percent Kalkaska soil and 35 to 50 percent Waiska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In places loamy or silty material is below a depth of 40 inches.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are small areas of the well drained Munising soils. Munising soils have a firm layer in the lower part of the subsoil. They are in landscape positions similar to those of the Kalkaska and Waiska soils. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Kalkaska soil and very rapid in the Waiska soil. The available water capacity is

low in the Kalkaska soil and very low in the Waiska soil. Runoff is slow on both soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, and seedling mortality are management concerns. The use of equipment is restricted by the dissected landscape and the slope. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Logging roads and skid trails should be established on the ridgetops, on the ravine bottoms, or diagonally across the side slopes. Loose sand can interfere with the traction of wheeled equipment. The number of suitable landing sites is severely limited by the slope. A few small gently sloping areas may be available for use as landing sites.

The erosion hazard is severe on the side slopes of the ravines. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting containerized seedlings or special nursery stock can reduce these losses.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management groups are 5a and Ga. The primary habitat type is ATD-D, and the secondary habitat type is AVO.

115B—Trimountain-Paavola complex, dissected, 1 to 12 percent slopes. These very deep, nearly level to moderately sloping, moderately well drained soils are on dissected uplands that have parallel or dendritic ravines 50 to 300 feet apart. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregularly shaped or elongated and range from 10 to 400 acres in size. They are 40 to 65 percent Trimountain soil and 20 to 35 percent Paavola soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, mottled, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, mottled, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand. In places bedrock is at a depth of 20 to 40 inches.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, mottled, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, mottled, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. The ravines have moderately steep to very steep side slopes. Also included are scattered small areas of the well drained Liminga and excessively drained Waiska soils in landscape positions similar to those of the Trimountain and Paavola soils. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. Both soils have a perched seasonal high water table at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is medium on the sides of the ravines and slow between the ravines. The available water capacity is low in the Trimountain soil and very low in the Paavola soil.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In these areas, however, the use of equipment is restricted in spring and in other excessively wet

periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. On year-round logging roads, a gravel base is needed. The erosion hazard is moderate or severe if the side slopes of the ravines are disturbed. Building logging roads and skid trails in the less sloping areas between the ravines or diagonally across the side slopes helps to prevent excessive soil loss. The best sites for landings are the nearly level areas between the ravines.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Paavola soil. Planting when the soils are moist can reduce these losses. Because of the seasonal high water table and the firm layer in the lower part of the subsoil, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3W. The land capability classification is IVe. The Michigan soil management groups are 3a-af and Ga/3-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

115D—Trimountain-Paavola complex, dissected, 8 to 35 percent slopes. These very deep, moderately sloping to steep, well drained soils are on dissected uplands. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The dendritic or parallel ravines are 10 to 35 feet deep and 35 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 10 to 40 feet wide. Some have seasonal streams. Individual areas of these soils are irregularly shaped or elongated and range from 130 to 500 acres in size. They are 40 to 70 percent Trimountain soil and 20 to 45 percent Paavola soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand. In places bedrock is at a depth of 20 to 40 inches.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are scattered small areas of the well drained Liminga and excessively drained Waiska soils in landscape positions similar to those of the Trimountain and Paavola soils. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. The available water capacity is low in the Trimountain soil and very low in the Paavola soil. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soils are wet, unsurfaced roads tend to be slippery and ruts form easily. On year-round logging roads, a gravel base is needed. The number of suitable landing sites is limited because of the slope and the

ravines. A few gently sloping areas may be available for use as landing sites.

On the side slopes of the ravines, erosion is a moderate hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding the roads after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Paavola soil. Planting when the soils are moist can reduce these losses. Because of the firm layer in the lower part of the subsoil, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management groups are 3a-af and Ga/3-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

115E—Trimountain-Paavola complex, dissected, 15 to 60 percent slopes. These very deep, moderately steep to very steep, well drained soils are on dissected uplands. Ridgetops are dominantly moderately steep or steep and are 75 to 100 feet wide. The dendritic or parallel ravines are 15 to 50 feet deep and 40 to 250 feet wide and have very steep side slopes. The ravine bottoms are 15 to 45 feet wide. Some have seasonal streams. Individual areas of these soils are irregularly shaped or elongated and range from 5 to 1,200 acres in size. They are 40 to 70 percent Trimountain soil and 20 to 45 percent Paavola soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand. In places bedrock is at a depth of 20 to 40 inches.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some areas where the ravine bottoms are stony or have exposures of bedrock. Also included are scattered small areas of the well drained Liminga and excessively drained Waiska soils in landscape positions similar to those of the Trimountain and Paavola soils. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. The available water capacity is low in the Trimountain soil and very low in the Paavola soil. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Access is easiest on the ridgetops and on the ravine bottoms. The use of equipment is briefly limited in spring and in other excessively wet periods. When the soils are wet, unsurfaced roads are slippery and ruts form easily. On year-round logging roads, a gravel base is needed. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Paavola soil. Planting when the soils are moist can reduce these losses. Because of the firm layer in the lower part of the subsoil, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep to very steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 3a-af and Ga/3-af. The primary habitat type is ATD, and the secondary habitat type is AVO.

116B—Trimountain-Paavola-Michigamme complex, dissected, 1 to 12 percent slopes, rocky. These nearly level to moderately sloping, moderately well drained soils are on dissected uplands that have parallel or dendritic ravines 50 to 300 feet apart. The Trimountain and Paavola soils are very deep, and the Michigamme soil is moderately deep. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregularly shaped or elongated and range from 10 to 600 acres in size. They are 40 to 60 percent Trimountain soil, 20 to 45 percent Paavola soil, and 15 to 35 percent Michigamme soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, mottled, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, mottled, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, mottled, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, mottled, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Typically, the Michigamme soil has a surface layer of dark reddish brown cobbly fine sandy loam about 3 inches thick. The subsurface layer is reddish brown cobbly fine sandy loam about 1 inch thick. The subsoil is about 25 inches thick. The upper part is dark reddish brown, friable fine sandy loam, and the lower part is reddish brown, mottled, firm cobbly sandy loam. Bedrock is at a depth of about 29 inches. In places the depth to bedrock is less than 20 inches.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. The ravines have moderately steep to very steep side slopes. Also included are scattered small areas of the well drained Liminga and excessively drained Waiska soils in landscape positions similar to those of the Trimountain, Paavola, and Michigamme soils and some areas of rock outcrop and very shallow soils. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. It is moderate in the Michigamme soil. All three soils have a perched seasonal high water table at a depth of 1 to 2 feet in spring and in other excessively wet periods. The available water capacity is low in the Trimountain and Michigamme soils and very low in the Paavola soil. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment

limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In these areas, however, the use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. On year-round logging roads, a gravel base is needed. The erosion hazard is moderate or severe if the side slopes of the ravines are disturbed. Building logging roads and skid trails in the less sloping areas between the ravines or diagonally across the side slopes helps to prevent excessive soil loss. The best sites for landings are the nearly level areas between the ravines. The bedrock and the rock outcrops can hinder road construction. Also, the rock outcrops can hinder harvesting. The best sites for landings are the nearly level areas between the ravines.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Paavola soil. Planting when the soils are moist can reduce these losses. Because of the seasonal high water table and the firm layer in the lower part of the subsoil, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are the dominant species on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3W. The land capability classification is VIs. The Michigan soil management groups are 3a-af, Ga/3-af, and 3/Ra. The primary habitat type is ATD, and the secondary habitat type is AVO.

116D—Trimountain-Paavola-Michigamme complex, dissected, 8 to 35 percent slopes, rocky. These moderately sloping to steep, well drained soils are on dissected uplands. The Trimountain and Paavola soils are very deep, and the Michigamme soil is moderately deep. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The ravines are parallel or dendritic, 15 to 35 feet deep, and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 8 to 35 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 250 acres in size. They are 40 to 60 percent Trimountain soil, 20 to 45 percent Paavola soil, and 15 to 35 percent Michigamme soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Typically, the Michigamme soil has a surface layer of dark reddish brown cobbly fine sandy loam about 3 inches thick. The subsurface layer is reddish brown cobbly fine sandy loam about 1 inch thick. The subsoil is about 25 inches thick. The upper part is dark reddish brown, friable fine sandy loam, and the lower part is reddish brown, firm cobbly sandy loam. Bedrock is at a depth of about 29 inches. In places the depth to bedrock is less than 20 inches.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and scattered small areas of the well drained Liminga and excessively drained Waiska soils in landscape positions similar to those of the Trimountain and Paavola soils. Also included are areas of rock outcrop and very shallow soils. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. It is moderate in the Michigamme soil. The available water capacity is low in the Trimountain and Michigamme soils and very low in the Paavola soil. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soils are wet, unsurfaced roads tend to be slippery and ruts form easily. On year-round logging roads, a gravel base is needed. The bedrock and the rock outcrops can hinder road construction. Also, the rock outcrops can hinder harvesting. The number of suitable landing sites is limited because of the slope and the ravines. A few gently sloping areas may be available for use as landing sites.

On the side slopes of the ravines, erosion is a moderate hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding the roads after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Paavola soil. Planting when the soils are moist can reduce these losses. Because of the firm layer in the lower part of the subsoil and the depth to bedrock, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIs. The Michigan soil management groups are 3a-af, Ga/3-af, and 3/Ra. The primary habitat type is ATD, and the secondary habitat type is AVO.

116E—Trimountain-Paavola-Michigamme complex, dissected, 15 to 60 percent slopes, rocky. These moderately steep to very steep, well drained soils are on dissected uplands. The Trimountain and Paavola soils are very deep, and the Michigamme soil is moderately deep. Ridgetops are dominantly moderately steep or steep and are 15 to 100 feet wide. The ravines are dominantly dendritic, 15 to 50 feet deep, and 40 to 250 feet wide and have very steep side slopes. The ravine bottoms are 15 to 45 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 10 to 425 acres in size. They are 40 to 60 percent Trimountain soil, 20 to 45 percent Paavola soil, and 15 to 35 percent Michigamme soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Typically, the Michigamme soil has a surface layer of dark reddish brown cobbly fine sandy loam about 3 inches thick. The subsurface layer is reddish brown cobbly fine sandy loam about 1 inch thick. The subsoil is about 25 inches thick. The upper part is dark reddish brown, friable fine sandy loam, and the lower part is reddish brown, firm cobbly sandy loam. Bedrock is at a

depth of about 29 inches. In places the depth to bedrock is less than 20 inches.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and scattered small areas of the well drained Liminga and excessively drained Waiska soils in landscape positions similar to those of the Trimountain and Paavola soils. Also included are areas of rock outcrop and very shallow soils. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. It is moderate in the Michigamme soil. The available water capacity is low in the Trimountain and Michigamme soils and very low in the Paavola soil. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Logging roads and skid trails should be established on the ridgetops, on the ravine bottoms, or diagonally across the side slopes. The use of equipment is briefly limited in spring and in other excessively wet periods. When the soils are wet, unsurfaced logging roads are slippery and ruts form easily. On year-round logging roads, a gravel base is needed. The bedrock and the rock outcrops can hinder road construction. Also, the rock outcrops can hinder harvesting. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails in the less sloping areas between the ravines, on the ridgetops, or diagonally across the side slopes and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Paavola soil. Planting when the soils are moist can reduce these losses. Because of the firm layer in the lower part of the subsoil and the depth to bedrock, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep to very steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management groups are 3a-af, Ga/3-af, and 3/Ra. The primary habitat type is ATD, and the secondary habitat type is AVO.

119A—Net-Witbeck complex, 0 to 3 percent slopes, rocky. These soils are very deep and nearly level. The somewhat poorly drained Net soil is on very low knolls and along the edges of the mapped areas. The poorly drained Witbeck soil is in depressions and drainageways and in the center of the mapped areas. It is subject to ponding. Stones and small boulders are in the surface layer of these soils. They typically are 10 to 36 inches in diameter and are rounded or semirounded. Individual areas of these soils are irregular in shape and range from 10 to 210 acres in size. They are 40 to 65 percent Net soil and 25 to 45 percent Witbeck soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Net soil has a surface layer of very dark brown stony fine sandy loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is dark reddish brown, friable fine sandy loam; the next part is reddish brown and dark reddish brown, mottled, firm fine sandy loam and gravelly fine sandy loam; and the lower part is reddish brown, mottled, friable gravelly loamy sand. The substratum to a depth of about 60 inches is reddish brown, mottled gravelly loamy sand. In places the subsoil is gravelly sand or sand.

Typically, the Witbeck soil has a surface layer about 10 inches thick. The upper part is black very stony muck, and the lower part is dark brown very stony silt loam. The subsoil is about 14 inches thick. It is mottled and friable. The upper part is brown sandy loam, and the lower part is brown gravelly sandy loam. The substratum to a depth of about 60 inches is brown gravelly loamy sand. In places it is gravelly sand or sand.

Included with these soils in mapping are small areas

of the moderately well drained Trimountain, Paavola, and Michigamme soils on low knolls. Michigamme soils are moderately deep over bedrock. Also included are areas of rock outcrop. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Net soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate in the upper part of the Witbeck soil and moderate or moderately slow in the lower part. In spring and in other excessively wet periods, the Net soil has a seasonal high water table at a depth of 0.5 foot to 1.5 feet and the Witbeck soil has one near or above the surface. Runoff is slow or very slow on both soils. The available water capacity is low.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted in late fall, in spring, and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts can expose tree roots and alter soil structure. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. The bedrock and rock outcrops can hinder road construction. Also, the rock outcrops can hinder harvesting. The large stones can reduce the operating speed of skidders and can damage equipment. The number of suitable landing sites is severely limited because of the wetness.

Because of the seasonal high water table, seedling losses can be as high as 20 to more than 50 percent on the Witbeck soil. Because of the firm layer in the subsoil and the wetness, trees on these soils are shallow rooted. Some may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control undesirable plants. Tree planting is severely limited by the wetness, the stoniness, and plant competition.

The woodland ordination symbol is 3X. The land capability classification is VIIw. The Michigan soil management groups are 3b-af and 3c. The primary habitat type is TMC, and the secondary habitat type is FI.

125—Kinross-Dawson complex. These very deep, nearly level soils are in depressions and swales associated with old beaches. They are subject to ponding. The Kinross soil is poorly drained, and the Dawson soil is very poorly drained. Individual areas are irregular in shape and range from 10 to 130 acres in size. They are 40 to 65 percent Kinross soil and 30 to 45 percent Dawson soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kinross soil has a surface layer of black muck about 3 inches thick. The subsurface layer is pinkish gray sand about 6 inches thick. The subsoil is sand about 40 inches thick. The upper part is brown and dark reddish brown, mottled, and very friable, and the lower part is reddish brown and loose. The substratum to a depth of about 60 inches is brown sand.

Typically, the Dawson soil has a surface layer of dark brown peat about 6 inches thick. The next layer is black mucky peat about 4 inches thick. The next 20 inches is very dark brown and black muck. The substratum to a depth of about 60 inches is brown sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Au Gres and moderately well drained Croswell soils. These included soils are on old beach ridges. They make up 5 to 10 percent of the unit.

Permeability is rapid in the Kinross soil. It is moderately slow to moderately rapid in the mucky layers of the Dawson soil and rapid in the substratum. The seasonal high water table is near or above the surface of both soils in spring and in other excessively wet periods. Runoff is very slow or ponded. The available water capacity is low in the Kinross soil and high in the Dawson soil.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on these mucky soils. Special harvesting equipment is needed. Access is easiest during periods in winter when access roads are frozen. The number of suitable landing sites is severely limited because of the wetness.

Because of the wetness and the organic surface layer, seedling losses can be more than 50 percent. Because of the wetness, trees are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After

trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control undesirable plants. Trees generally are not planted on these soils because of the wetness, seedling mortality, and plant competition.

The woodland ordination symbol is 2W. The land capability classification is VIIw. The Michigan soil management groups are 5c-a and M/4c-a. The primary habitat type is PCS, and the secondary habitat type is TMC-Vac.

127B—Keweenaw-Kalkaska complex, dissected, 1 to 12 percent slopes. These very deep, nearly level to moderately sloping soils are on dissected uplands that have parallel ravines 50 to 300 feet apart. The Keweenaw soil is well drained, and the Kalkaska soil is somewhat excessively drained. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have strongly sloping to very steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 285 acres in size. They are 30 to 50 percent Keweenaw soil and 25 to 45 percent Kalkaska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Keweenaw soil has a surface layer of black gravelly loamy sand about 2 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, very friable gravelly loamy sand; the next part is dark reddish brown and reddish brown, friable and very friable gravelly loamy sand; and the lower part is reddish brown, firm fine sandy loam and light reddish brown loamy fine sand. The substratum to a depth of about 60 inches is reddish brown loamy sand. In some places the subsoil and substratum are very gravelly sand. In other places the lower part of the subsoil is mottled.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some areas layers of gravelly sand are in the substratum. In places stratified, loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are small areas of the moderately well drained Munising and Yalmer soils. These included soils have a perched seasonal high water table. They are in landscape positions similar to those of the Keweenaw and Kalkaska soils. Also included are small areas of somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. The ravines have moderately steep to very steep side slopes. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the Keweenaw soil and rapid in the Kalkaska soil. The available water capacity is low in both soils. Runoff is slow.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Erosion is a moderate hazard on the side slopes of the ravines. Building logging roads and skid trails in the less sloping areas between the ravines or diagonally across the side slopes helps to prevent excessive soil loss. The best sites for landings are the nearly level areas between the ravines.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting containerized seedlings or special nursery stock can reduce these losses. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Keweenaw soil is 3A, and that assigned to the Kalkaska soil is 3S. The land capability classification of both soils is IIIe. The Michigan soil management groups are 4a-a and 5a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

127D—Keweenaw-Kalkaska complex, dissected, 8 to 35 percent slopes. These very deep, moderately sloping to steep soils are on dissected uplands. The Keweenaw soil is well drained, and the Kalkaska soil is somewhat excessively drained. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The ravines are dominantly

parallel, 10 to 35 feet deep, and 20 to 100 feet wide and have strongly sloping to very steep side slopes. The ravine bottoms are 5 to 25 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 10 to 160 acres in size. They are 50 to 60 percent Keweenaw soil and 35 to 45 percent Kalkaska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Keweenaw soil has a surface layer of black gravelly loamy sand about 2 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, very friable gravelly loamy sand; the next part is dark reddish brown and reddish brown, friable and very friable gravelly loamy sand; and the lower part is reddish brown, firm fine sandy loam and light reddish brown loamy fine sand. The substratum to a depth of about 60 inches is reddish brown loamy sand. In places the subsoil and substratum are very gravelly sand.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places stratified, loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are small areas of the moderately well drained Munising and Yalmer soils. These included soils have a firm layer in the lower part of the subsoil. They are in landscape positions similar to those of the Keweenaw and Kalkaska soils. Also included are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the Keweenaw soil and rapid in the Kalkaska soil. The available water capacity is low in both soils. Runoff is slow.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. Loose sand can interfere with the traction of wheeled equipment, especially during dry periods. The number of suitable landing sites is very limited. A few gently sloping areas between the ravines may be available for use as landing sites. Erosion is a moderate or severe hazard on the side slopes of the ravines. It results from the concentration of runoff on skid trails, on logging roads, and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes helps to control erosion. Seeding the roads, trails, and landings after the trees are logged also helps to control erosion. Because of droughtiness, seedling losses can be as high as 25 to 50 percent.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. Special harvest methods may be needed to control plant competition. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management groups are 4a-a and 5a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

127E—Keweenaw-Kalkaska complex, dissected, 15 to 60 percent slopes. These very deep, moderately steep to very steep soils are on dissected uplands. The Keweenaw soil is well drained, and the Kalkaska soil is somewhat excessively drained. Ridgetops are dominantly moderately steep or steep and are 15 to 100 feet wide. The ravines are dominantly parallel, 15 to 50 feet deep, and 40 to 150 feet wide and have strongly sloping to very steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 10 to 170 acres in size. They are 45 to 55 percent Keweenaw soil and 40 to 50 percent Kalkaska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Keweenaw soil has a surface layer of black gravelly loamy sand about 2 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, very friable gravelly loamy sand; the next part is dark reddish brown and reddish brown, friable and very friable gravelly loamy sand; and the lower part is reddish brown, firm fine sandy loam and light reddish brown loamy fine sand. The substratum to a depth of about 60 inches is reddish brown loamy sand. In places the subsoil and substratum are very gravelly sand.

Typically, the Kalkaska soil has about 1 inch of black,

partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places stratified, loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are small areas of the well drained Alcona and Munising soils. These included soils have a higher water-holding capacity and are in landscape positions similar to those of the Keweenaw and Kalkaska soils. Also included are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the Keweenaw soil and rapid in the Kalkaska soil. The available water capacity is low in both soils. Runoff is rapid.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape and the slope. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Access is easiest on the ridgetops and on the ravine bottoms. Loose sand can interfere with the traction of wheeled equipment during dry periods. The number of suitable landing sites is severely limited by the slope. Suitable landing sites generally are not available because of the slope and the ravines.

The erosion hazard is severe on the side slopes of the ravines. It results from the concentration of runoff on skid trails and in the tracks of wheeled equipment. Building logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes, removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting containerized seedlings or special nursery stock can reduce these losses. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. Because of the dissected landscape and the moderately steep to very steep side slopes of the ravines, site preparation and machine planting are difficult or impractical.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 4a-a and 5a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

130B—Munising-Alcona-Liminga complex, dissected, 1 to 12 percent slopes. These very deep, nearly level to moderately sloping soils are on dissected uplands that have parallel ravines 50 to 300 feet apart. The Munising soil is moderately well drained, and the Alcona and Liminga soils are well drained. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have strongly sloping to very steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are elongated or irregular in shape and range from 10 to 500 acres in size. They are 35 to 55 percent Munising soil, 15 to 35 percent Alcona soil, and 15 to 35 percent Liminga soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the upper part of the subsoil is sand. In a few areas the substratum is sandy.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Typically, the Liminga soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish

brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand. In places the soil is sand throughout.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. The ravines have moderately steep to very steep side slopes. Also included are areas where the ravine bottoms have exposures of bedrock. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is moderate in the Alcona soil and rapid in the Liminga soil. In spring and in other excessively wet periods, the Munising soil has a perched seasonal high water table at a depth of 1 to 2 feet. The available water capacity is low in the Munising and Liminga soils and moderate in the Alcona soil. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In these areas on the Alcona and Munising soils, however, the use of equipment is restricted in spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in areas of the Liminga soil can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. The erosion hazard is moderate if the side slopes of the ravines are disturbed. Building logging roads and skid trails in the less sloping areas between the ravines or diagonally across the side slopes helps to prevent excessive soil loss. The best sites for landings are the nearly level areas between the ravines.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Liminga soil. Planting containerized seedlings or special planting stock can reduce these losses. Because of the firm layer in the subsoil, trees on the Munising soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Munising soil is 3W, that assigned to the Alcona soil is 3L, and that assigned to the Liminga soil is 3S. The land capability classification of all three soils is IIIe. The Michigan soil management groups are 3a-af, 3a-s, and 4a. The primary habitat type is ATD, and the secondary habitat type is AVO.

130D—Munising-Alcona-Liminga complex, dissected, 8 to 35 percent slopes. These very deep, moderately sloping to steep, well drained soils are on dissected uplands. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The ravines are dominantly parallel, 10 to 35 feet deep, and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are elongated or irregular in shape and range from 5 to 500 acres in size. They are 25 to 55 percent Munising soil, 15 to 40 percent Alcona soil, and 15 to 40 percent Liminga soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places the upper part of the subsoil is sand.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Typically, the Liminga soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand. In places the soil is sand throughout.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are areas where the ravine bottoms have exposures of bedrock. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate or moderately slow in the lower part. It is moderate in the Alcona soil and rapid in the Liminga soil. The available water capacity is low in the Munising and Liminga soils and moderate in the Alcona soil. Runoff is medium on the sides of the ravines and slow between the ravines.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. In these areas on the Munising and Alcona soils, however, the use of equipment is briefly restricted in spring and in other excessively wet periods. When the soils are wet, unsurfaced roads tend to be slippery and ruts form easily. Loose sand in areas of the Liminga soil can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. The number of suitable landing sites is limited because of the slope and the ravines. A few gently sloping areas between the ravines may be available for use as landing sites.

If the side slopes of the ravines are disturbed, erosion is a moderate hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding the roads after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Liminga soils. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the firm layer in the subsoil, trees are shallow rooted on the Munising soil. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management groups are 3a-af, 3a-s, and 4a. The primary habitat type is ATD, and the secondary habitat type is AVO.

130F—Munising-Alcona-Liminga complex, dissected, 15 to 70 percent slopes. These very deep, moderately steep to very steep, well drained soils are on dissected uplands. Ridgetops are dominantly moderately steep or steep and are 10 to 75 feet wide. The ravines are parallel or dendritic, 20 to 75 feet deep, and 45 to 300 feet wide and have very steep side slopes. The ravine bottoms are 10 to 60 feet wide. Individual areas are elongated or irregular in shape and range from 5 to 800 acres in size. They are 25 to 45 percent Munising soil, 15 to 40 percent Alcona soil, and 15 to 40 percent Liminga soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In places the upper part of the subsoil is sand.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Typically, the Liminga soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish

brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand. In places the soil is sand throughout.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are some areas where the ravine bottoms have exposures of bedrock. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is moderate in the Alcona soil and rapid in the Liminga soil. The available water capacity is low in the Munising and Liminga soils and moderate in the Alcona soil. Runoff is medium on all three soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape and the slope. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Logging roads and skid trails should be established on the ridgetops or on the ravine bottoms. In spring and in other excessively wet periods, the use of equipment is briefly restricted in areas of the Munising and Alcona soils. When the soils are wet, logging roads are slippery and ruts form easily. Loose sand can interfere with the traction of wheeled equipment during dry periods. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Establishing the logging roads and skid trails on the contour, removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Liminga soils. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the dissected landscape and the very steep side slopes of the ravines, however, site preparation and machine planting are difficult or impractical. Because of the firm layer in the subsoil, trees on the Munising soil are shallow rooted. Some may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 3a-af, 3a-s, and 4a. The primary habitat type is ATD, and the secondary habitat type is AVO.

131B—Graveraet-Misery complex, 0 to 8 percent slopes. These very deep soils are on broad plains. The nearly level and undulating, moderately well drained Graveraet soil is on low knolls. The nearly level, somewhat poorly drained Misery soil is in depressions and waterways. Individual areas of these soils are irregular in shape and range from 5 to 1,120 acres in size. They are 40 to 70 percent Graveraet soil and 20 to 55 percent Misery soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Graveraet soil has a surface layer of black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, mottled, firm fine sandy loam and reddish brown, mottled, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In some places the substratum is more acidic. In other places sandstone bedrock is within a depth of 40 inches.

Typically, the Misery soil has a surface layer of black very fine sandy loam about 4 inches thick. The subsurface layer is dark reddish gray, mottled very fine sandy loam about 3 inches thick. The subsoil is about 31 inches thick. The upper part is reddish brown, mottled, friable very fine sandy loam; the next part is reddish brown, mottled, firm loam mixed with light brown, firm fine sandy loam; and the lower part is reddish brown, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In places the upper part of the subsoil is sand or loamy sand.

Included with this soil in mapping are small areas of the poorly drained Gay soils in depressions. These soils are on the lowest parts of the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Graveraet and Misery soils, very slow in the next part, and moderate or moderately slow in the lower part. In spring and in other excessively wet periods, the Graveraet soil has a perched seasonal high water table at a depth of 1 to 2 feet and the Misery soil has one at a depth of 0.5 foot to 1.5 feet. The Misery soil remains wet for longer periods than the Munising soil. Runoff is slow on both soils. The available water capacity is low.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. When the soils are wet, unsurfaced logging roads are slippery and ruts form easily. Deep ruts can expose tree roots and restrict lateral drainage. Equipment should be used only when the soils are dry or have an adequate snow cover. Year-round logging roads should be graveled. Culverts are needed to maintain the natural drainage system. The best sites for landings are the nearly level areas of the Graveraet soil.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent on the Misery soil. Timely planting and selection of special nursery stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Because of the firm layer in the subsoil and the seasonal high water table in both soils, trees are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods and site preparation may be needed to control undesirable plants.

A few areas are used as hayland or pasture. These soils are well suited to hay and pasture. The major management concerns are compaction, the seasonal high water table, and the low available water capacity. Grassed waterways help to remove surface water. Overgrazing or grazing when the soils are wet can cause surface compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol is 3W. The land capability classification is IIe. The Michigan soil management groups are 2.5a-af and 3b-af. The primary habitat type is ATD, and the secondary habitat type is TMC.

132B—Kalkaska-Alcona complex, dissected, 1 to 12 percent slopes. These very deep, nearly level to moderately sloping soils are on dissected uplands that have parallel ravines 50 to 300 feet apart. The Kalkaska soil is somewhat excessively drained, and the Alcona soil is well drained. The ravines are 5 to 15 feet deep and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 175 acres in size. They are 55 to 85 percent Kalkaska soil and 15 to 35 percent Alcona soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Included with these soils in mapping are small areas of somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. The ravines have moderately steep to very steep side slopes. Also included are small areas of the moderately well drained Yalmer soils. Yalmer soils have a perched seasonal high water table. They are in landscape positions similar to those of the Kalkaska and Alcona soils. Included areas make up 5 to 10 percent of the unit.

Permeability is rapid in the Kalkaska soil and moderate in the Alcona soil. The available water capacity is low in the Kalkaska soil and moderate in the

Alcona soil. Runoff is slow on both soils.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Erosion is a moderate hazard on the side slopes of the ravines. Building logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes helps to prevent excessive soil loss. The best sites for landings are the nearly level areas between the ravines.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soils. Planting containerized seedlings or special nursery stock can reduce these losses. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

A few areas are used as hayland or pasture. These soils are fairly suited to hay and pasture. The major management concern is the low available water capacity. Proper stocking rates, rotation grazing, and restricted use during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Kalkaska soil is 3S, and that assigned to the Alcona soil is 3L. The land capability classification of both soils is IVs. The Michigan soil management groups are 5a and 3a-s. The primary habitat type is ATD-D, and the secondary habitat type is TM.

132D—Kalkaska-Alcona complex, dissected, 8 to 35 percent slopes. These very deep, moderately sloping to steep soils are on dissected uplands. The Kalkaska soil is somewhat excessively drained, and the Alcona soil is well drained. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The parallel ravines are 10 to 35 feet deep and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 5 to 55 acres in size. They are 55 to 85 percent Kalkaska soil and 15 to 35 percent Alcona soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some areas layers of gravelly sand are in the substratum. In a few areas stratified, loamy or silty material is below a depth of 40 inches.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Included with these soils in mapping are small areas of somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are small areas of the well drained Munising soils in landscape positions similar to those of the Kalkaska and Alcona soils. Munising soils have a firm layer in the lower part of the subsoil. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Kalkaska soil and moderate in the Alcona soil. The available water capacity is low in the Kalkaska soil and moderate in the Alcona soil. Runoff is slow on both soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines and on the ridgetops. Loose sand can interfere with the traction of wheeled equipment, especially during dry periods. The number of suitable landing sites is very limited. Erosion is a moderate hazard on the side slopes of the ravines. It results from the concentration of runoff on skid trails, on logging roads, and in the tracks of wheeled equipment. Building the logging roads and skid trails in the less sloping areas between the ravines, on the ridgetops, or diagonally across the side slopes helps to control erosion. Seeding the roads, trails, and landings after the trees are logged also helps to control erosion.

Northern hardwoods are dominant on these soils.

Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. Special harvest methods may be needed to control plant competition. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management groups are 5a and 3a-s. The primary habitat type is ATD-D, and the secondary habitat type is TM.

132F—Kalkaska-Alcona complex, dissected, 15 to 70 percent slopes. These very deep, moderately steep to very steep soils are on dissected uplands. The Kalkaska soil is somewhat excessively drained, and the Alcona soil is well drained. Ridgetops are dominantly moderately steep or steep and are 10 to 50 feet wide. The ravines are parallel or dendritic, 20 to 75 feet deep, and 50 to 300 feet wide and have very steep side slopes. The ravine bottoms are 10 to 60 feet wide. Individual areas are irregular in shape and range from 5 to 480 acres in size. They are 45 to 85 percent Kalkaska soil and 15 to 35 percent Alcona soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In a few places stratified, loamy or silty material is below a depth of 40 inches.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are small areas of the well drained Munising soils in landscape positions similar to those of the Kalkaska and Alcona soils. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Kalkaska soil and moderate in the Alcona soil. The available water capacity is low in the Kalkaska soil and moderate in the Alcona soil. Runoff is medium on both soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape and the slope. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Logging roads and skid trails should be established on the ravine bottoms or on the ridgetops. Loose sand can interfere with the traction of wheeled equipment during dry periods. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the contour, removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soil. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the dissected landscape and the very steep side slopes of the ravines, however, site preparation and machine planting are difficult or impractical. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management groups are 5a and 3a-s. The primary habitat type is ATD-D, and the secondary habitat type is TM.

133B—Liminga-Alcona complex, 0 to 8 percent slopes. These very deep, nearly level and gently sloping, well drained soils are on broad plains.

Individual areas are irregular in shape and range from 5 to 280 acres in size. They are 35 to 50 percent Liminga soil and 20 to 40 percent Alcona soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Liminga soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Included with these soils in mapping are small areas of the moderately well drained Halfaday soils in slight depressions. Also included are areas of the moderately well drained Yalmer soils. Yalmer soils have a perched water table. They are in landscape positions similar to those of the Liminga and Alcona soils. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Liminga soil and moderate in the Alcona soil. The available water capacity is low in the Liminga soil and moderate in the Alcona soil. Runoff is slow on both soils.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. In areas of the Alcona soil, the use of equipment is briefly limited in spring and in other excessively wet periods. When the soils are wet, unsurfaced logging roads tend to be slippery and ruts form easily. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Year-round logging roads should be graveled. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Liminga soil. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control undesirable plants. Before trees are planted, site preparation by mechanical or chemical means generally is needed to control plant competition.

These soils are fairly well suited to crops. The major management concerns are water erosion, wind erosion, droughtiness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Contour stripcropping, buffer strips, and field windbreaks reduce the hazard of wind erosion. Returning crop residue to the soils, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

These soils are well suited to pasture and hay. The major management concern is the low available water capacity. Proper stocking rates, rotation grazing, and restricted grazing during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Liminga soil is 3S, and that assigned to the Alcona soil is 3L. The land capability classification of both soils is IIIs. The Michigan soil management groups are 4a and 3a-s. The primary habitat type is ATD-D, and the secondary habitat type is TM.

133D—Liminga-Alcona complex, 8 to 15 percent slopes. These very deep, gently rolling and rolling, well drained soils are on knolls, side slopes, and broad plains. Individual areas are irregular in shape and range from 50 to 140 acres in size. They are 35 to 60 percent Liminga soil and 30 to 55 percent Alcona soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Liminga soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Included with these soils in mapping are small areas

of the moderately well drained Halfaday soils in slight depressions. Also included are areas of the moderately well drained Yalmer soils. Yalmer soils have a perched water table. They are in landscape positions similar to those of the Liminga and Alcona soils. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Liminga soil and moderate in the Alcona soil. The available water capacity is low in the Liminga soil and moderate in the Alcona soil. Runoff is slow on both soils.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. In areas of the Alcona soil, the use of equipment is briefly limited in spring and in other excessively wet periods. When the soils are wet, unsurfaced logging roads tend to be slippery and ruts form easily. Loose sand in heavily traveled areas of the Liminga soil can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Year-round logging roads should be graveled. Landings can be established in small nearly level areas, if any are available.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Liminga soil. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

These soils are fairly well suited to crops. The major management concerns are water erosion, wind erosion, droughtiness, and the organic matter content. Cover crops, close-growing crops, and grassed waterways reduce the runoff rate and thus help to control erosion. Contour stripcropping, buffer strips, and field windbreaks reduce the hazard of wind erosion. Returning crop residue to the soils, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

These soils are well suited to pasture and hay. The major management concern is the low available water capacity. Proper stocking rates, rotation grazing, and restricted grazing during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Liminga soil is 3S, and that assigned to the Alcona soil is 3L. The land capability classification of both soils is IIIe. The Michigan soil management groups are 4a and 3a-s. The primary habitat type is ATD-D, and the secondary habitat type is TM.

133E—Liminga-Alcona complex, 15 to 35 percent slopes. These very deep, hilly and steep, well drained soils are on hills and side slopes. Individual areas are irregular in shape and range from 5 to 180 acres in size. They are 40 to 65 percent Liminga soil and 30 to 45 percent Alcona soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Liminga soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, stratified fine sand, loamy fine sand, and fine sandy loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Au Gres soils in slight depressions. Also included are areas of the well drained Yalmer soils in landscape positions similar to those of the Liminga and Alcona soils. Yalmer soils have a firm layer in the subsoil. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Liminga soil and moderate in the Alcona soil. The available water capacity is low in the Liminga soil and moderate in the Alcona soil. Runoff is slow on both soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, and plant competition are management concerns. In areas of the Alcona soil, the use of equipment is briefly limited in spring and in other excessively wet periods. When the soils are wet, unsurfaced logging roads tend to be slippery and ruts form easily. The slope and loose sand in areas of the Liminga soil can interfere with the traction of wheeled equipment. The slope limits the

number of suitable sites for logging roads and landings. Logging roads and skid trails can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The landings can be established in small nearly level areas, if any are available. Erosion can result from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures helps to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Liminga soil. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management groups are 4a and 3a-s. The primary habitat type is ATD-D, and the secondary habitat type is TM.

134A—Halfaday-Au Gres sands, 0 to 3 percent slopes. This map unit consists of a very deep, nearly level, moderately well drained Halfaday soil on low knolls and a deep, nearly level, somewhat poorly drained Au Gres soil in slight depressions. Individual areas are irregular in shape and range from 5 to 800 acres in size. They are 20 to 70 percent Halfaday soil and 25 to 50 percent Au Gres soil. The two soils are so intricately mixed or so small that mapping them separately was not practical.

Typically, the Halfaday soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is pinkish gray sand about 3 inches thick. The subsoil is dark reddish brown, yellowish red, and strong brown, friable sand about 27 inches thick. The substratum to a depth of about 60 inches is light brown and reddish brown, mottled sand. In some places the soil is fine sand throughout. In other places loamy or silty material is below a depth of 40 inches.

Typically, the Au Gres soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light brownish gray, mottled sand about 19 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, loose sand about 20 inches thick. The substratum to a depth of about 60 inches is brown sand. In places it is loamy.

Included with these soils in mapping are small areas of the poorly drained Roscommon soils in depressions and the somewhat excessively drained Kalkaska soils in the highest positions on the landscape. These included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Halfaday and Au Gres soils. In spring and in other excessively wet periods, the Halfaday soil has a seasonal high water table at a depth of 2.0 to 3.5 feet and the Au Gres soil has one at a depth of 0.5 foot to 1.5 feet. The available water capacity is low in both soils. Runoff is slow.

These soils are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The main limitation is seasonal wetness in the lower areas. Equipment can be used only when the soil is relatively dry or has an adequate snow cover or when the roads and landings are sufficiently frozen. In the higher positions loose sand in heavily traveled areas can interfere with the traction of wheeled equipment during dry periods. The best landing sites are in areas of the included Kalkaska soils. Because of wetness in the lower areas, trees are shallow rooted. They may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of seasonal droughtiness on the Halfaday soil and seasonal wetness on the Au Gres soil, seedling losses can be as high as 25 to 50 percent. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Before trees are planted, site preparation by mechanical or chemical means generally is needed to control the plant competition.

The woodland ordination symbol assigned to the Halfaday soil is 3S, and that assigned to the Au Gres soil is 6W. The land capability classification of both soils is IIIs. The Michigan soil management groups are 5a and 5b. The primary habitat type is ATD-D, and the secondary habitat type is TMC.

135D—Deer Park-Kinross complex, 0 to 15 percent slopes. These very deep soils are on plains. The nearly level to rolling, excessively drained Deer Park soil is on dunes and low ridges. The nearly level, poorly drained

Kinross soil is in swales and depressions. It is subject to ponding. Individual areas of these soils are irregular in shape and range from 15 to 190 acres in size. They are 50 to 60 percent Deer Park soil and 30 to 40 percent Kinross soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Deer Park soil has about 2 inches of black, partially decomposed leaf litter on the surface. The surface layer is black sand about 4 inches thick. The subsurface layer is pale brown sand about 20 inches thick. The subsoil is brown and yellowish brown, loose sand about 12 inches thick. The substratum to a depth of about 60 inches is pale brown sand. In places it is gravelly sand.

Typically, the Kinross soil has a surface layer of black muck about 3 inches thick. The subsurface layer is pinkish gray sand about 6 inches thick. The subsoil is sand about 40 inches thick. The upper part is brown and dark reddish brown and is mottled and very friable, and the lower part is reddish brown and loose. The substratum to a depth of about 60 inches is brown sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Au Gres and moderately well drained Croswell soils. These included soils occur as narrow strips between the Deer Park and Kinross soils. Also included are small areas of Histosols, Aquents, and water on the lowest parts of the landscape. Included areas make up 10 to 15 percent of the unit.

Permeability is rapid in both soils. The Kinross soil has a seasonal high water table near or above the surface in spring and in other excessively wet periods. Runoff is very slow on the Deer Park soil and very slow or ponded on the Kinross soil. The available water capacity is low in both soils.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The Kinross soil is wet from fall to spring and can be wet during other periods. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. The best sites for landings are nearly level areas of the Deer Park soil and the included Croswell soils.

Seedling losses can be more than 50 percent because of droughtiness in the Deer Park soil and because of wetness in the Kinross soil. In areas of the Deer Park soil, these losses can be reduced by planting when the soil is moist and by selecting containerized seedlings or special nursery stock for planting. Trees generally are not planted on the Kinross soil because of wetness and plant competition. Because of the wetness, trees on this soil are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration on the Kinross soil unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants.

The woodland ordination symbol assigned to the Deer Park soil is 4S, and that assigned to the Kinross soil is 2W. The land capability classification of both soils is VIIs. The Michigan soil management groups are 5.3a and 5c. The primary habitat type is QAE, and the secondary habitat type is PCS.

136B—Michigamme-Net complex, 0 to 8 percent slopes, rocky. This map unit consists of a nearly level and gently sloping, moderately deep, moderately well drained Michigamme soil and a nearly level, very deep, somewhat poorly drained Net soil. The Michigamme soil is on low knolls, and the Net soil is in depressions and drainageways. Stones and small boulders are on the surface. They typically are 10 to 36 inches in diameter, are 1 to 10 feet apart, and are rounded or semirounded. Individual areas of these soils are irregular in shape and range from 10 to 300 acres in size. They are 35 to 60 percent Michigamme soil and 20 to 35 percent Net soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Michigamme soil has a surface layer of dark reddish brown cobbly fine sandy loam about 3 inches thick. The subsurface layer is reddish brown cobbly fine sandy loam about 1 inch thick. The subsoil is about 25 inches thick. The upper part is dark reddish brown, friable fine sandy loam, and the lower part is reddish brown, mottled, firm cobbly sandy loam. Bedrock is at a depth of about 29 inches. In places the depth to bedrock is less than 20 inches.

Typically, the Net soil has a surface layer of very dark brown stony fine sandy loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is dark reddish brown, friable fine sandy loam; the next part is reddish brown and dark reddish brown, mottled, firm fine sandy loam and gravelly fine sandy loam; and the lower part is reddish brown, mottled, friable gravelly

loamy sand. The substratum to a depth of about 60 inches is reddish brown, mottled gravelly loamy sand. In places the subsoil is sand.

Included with these soils in mapping are small areas of the poorly drained Witbeck soils in depressions and drainageways and small areas of the deep, moderately well drained Trimountain soils in landscape positions similar to those of the Michigamme soil. Also included are areas of rock outcrop and very shallow soils. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the Michigamme soil. It is moderate in the upper part of the Net soil, very slow in the next part, and moderate or moderately rapid in the lower part. In spring and in other excessively wet periods, the Michigamme soil has a perched seasonal high water table at a depth of 1 to 2 feet and the Net soil has one at a depth of 0.5 foot to 1.5 feet. The Net soil remains wet for longer periods than the Michigamme soil. The available water capacity is low in both soils. Runoff is slow.

These soils are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used during these periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. A gravel base is needed on year-round logging roads. Culverts are needed to maintain the natural drainage system. The best sites for landings are the nearly level areas of the Michigamme soil.

Because of the firm layer in the subsoil of the Net soil, the seasonal high water table in both soils, and the depth to bedrock in the Michigamme soil, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species.

The woodland ordination symbol assigned to the Michigamme soil is 3W, and that assigned to the Net soil is 3X. The land capability classification of both soils is VIs. The Michigan soil management groups are 3/Ra and 3b-af. The primary habitat type is ATD, and the secondary habitat type is TMC.

137A—Sturgeon-Arnheim-Pelkie complex. These very deep, nearly level soils are on flood plains along streams and rivers. They are occasionally flooded (fig. 12). The Sturgeon soil is on low terraces and is somewhat poorly drained; the Arnheim soil is in old stream channels and is poorly drained; and the Pelkie soil is on low knolls, ridges, and terraces and is moderately well drained. Individual areas are linear in shape and range from 5 to 150 acres in size. They are 40 to 60 percent Sturgeon soil, 15 to 40 percent Arnheim soil, and 15 to 30 percent Pelkie soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Sturgeon soil has a surface layer of reddish brown silt loam about 8 inches thick. The upper part of the substratum is reddish brown, mottled very fine sandy loam and silt loam; the next part is reddish brown, mottled loamy very fine sand; and the lower part to a depth of about 60 inches is dark reddish gray fine sand. In some places the lower part of the substratum is loamy. In other places the soil is fine sand or loamy fine sand throughout.

Typically, the Arnheim soil has a surface layer of reddish brown silt loam about 4 inches thick. The upper part of the substratum is dark reddish gray, mottled silt loam; the next part is reddish brown, mottled silt loam; and lower part to a depth of about 60 inches is brown and dark brown, stratified loamy fine sand, very fine sandy loam, and fine sand. In some places the surface layer is muck 6 to 12 inches thick. In other places the substratum has a layer of muck.

Typically, the Pelkie soil has a surface layer of reddish brown fine sand about 7 inches thick. The substratum to a depth of about 60 inches is reddish brown loamy fine sand and light reddish brown, mottled fine sand. In places it is not mottled.

Included with these soils in mapping are small areas of the very poorly drained Cathro and Tawas soils in depressions. Also included are small areas of the excessively drained Kalkaska and Waiska soils on upland ridges and knolls. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Sturgeon soil and rapid in the lower part. It is moderate in the Arnheim soil and rapid in the Pelkie soil. The available water capacity is moderate in the Sturgeon and Arnheim soils and low in the Pelkie soil. Surface runoff is slow on the Sturgeon soil, very slow or ponded on the Arnheim soil, and very slow on the Pelkie soil. The Sturgeon soil has a seasonal high water table at a

Figure 12.—Spring flooding in an area of Sturgeon-Arnheim-Pelkie complex.

depth of 0.5 foot to 1.5 feet from fall through spring, the Arnheim soil has one at or near the surface from fall through spring, and the Pelkie soil has one at a depth of 2.5 to 5.0 feet from fall through spring.

Most areas of these soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted in the lower areas in spring and in other excessively wet periods. Equipment should be used only when the soils are dry or have an adequate snow cover. Logging roads tend to be slippery and ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Year-round logging roads should be graveled, and culverts should be installed where needed. The best sites for landings are areas of the adjacent well drained soils.

Because of wetness in the lower areas and droughtiness in the upper areas of these soils, seedling losses can be as high as 25 to more than 50 percent. Trees generally are not planted on the poorly drained soils. Planting containerized seedlings or special nursery stock can reduce the mortality rate in the sandier areas. After trees are cut, plant competition can prevent or delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Because of the wetness in the lower areas, trees are shallow rooted. They may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

The woodland ordination symbol assigned to the Sturgeon soil is 3W, that assigned to the Arnheim soil is 5W, and that assigned to the Pelkie soil is 3A. The land capability classification of all three soils is IIIw. The Michigan soil management groups are L-2b, L-2c, and L-4a. The primary habitat type is AVO-CI, and the secondary habitat type is FMC.

138—Bergland muck. This very deep, nearly level, poorly drained soil is in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, about 5 inches of black muck is at the surface. The surface layer is very dark gray, mottled silty clay about 4 inches thick. The subsoil is about 11 inches thick. The upper part is dark reddish gray, mottled, firm clay, and the lower part is reddish brown, firm clay. The substratum to a depth of about 60 inches is reddish brown clay and silty clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Rudyard soils in the slightly higher positions on the landscape. These soils make up 5 to 10 percent of the unit.

Permeability is very slow. The available water capacity is moderate. The seasonal high water table is near or above the surface in spring and in other excessively wet periods. Runoff is very slow or ponded.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soil is usually wet from fall to spring and can be wet during other periods. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. On year-round logging roads, roadfill and gravel are needed. Culverts are needed to maintain the natural drainage system. The number of suitable landing sites is severely limited because of the wetness.

Because of the wetness, seedling losses can be as high as 25 to 50 percent and trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to prevent or delay natural regeneration unless precautionary measures are applied. Special harvesting methods may be needed to control the undesirable plants. Trees generally are not planted on this soil because of the wetness and plant competition.

The woodland ordination symbol is 6W. The land capability classification is Vw. The Michigan soil management group is 0c. The primary habitat type is FI, and the secondary habitat type is TTS.

139B—Trimountain-Paavola-Waiska complex, 1 to 8 percent slopes. These very deep, nearly level and gently sloping soils are on low knolls and broad plains. The Trimountain and Paavola soils are moderately well drained, and the Waiska soil is excessively drained. Individual areas are irregular in shape and range from 10 to 1,000 acres in size. They are 40 to 60 percent Trimountain soil, 15 to 40 percent Paavola soil, and 15 to 30 percent Waiska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, mottled, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, mottled, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, mottled, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, mottled, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Net soils in depressions and drainageways. Also included are scattered small areas of the somewhat excessively drained Kalkaska and well drained Keweenaw soils in landscape positions similar to those of the Trimountain, Paavola, and Waiska soils. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is

moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. It is very rapid in the Waiska soil. The Trimountain and Paavola soils have a perched seasonal high water table at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is slow on all three soils. The available water capacity is low in the Trimountain soil and very low in the Paavola and Waiska soils.

Most areas are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is limited in spring and in other excessively wet periods on the Trimountain and Paavola soils. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. The best sites for landings are the nearly level areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. On year-round logging roads, a gravel base is needed.

Because of droughtiness, seedling mortality is a problem on the Paavola and Waiska soils. Furrowing or bedding before trees are planted helps to reduce the seedling mortality rate. Because of the very firm layer in the subsoil of the Trimountain and Paavola soils, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

If these soils are used as hayland or pasture, the major management concerns are compaction, the seasonal high water table, and the low available water capacity. Grassed waterways help to remove excess water. Overgrazing or grazing when the soils are wet can cause compaction and deplete the cover of forage plants. Proper stocking rates, rotation grazing, and restricted grazing during wet or excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Trimountain and Paavola soils is 3W, and that assigned to the Waiska soil is 3S. The land capability classification of all three soils is VIs. The Michigan soil management groups are 3a-af, Ga/3-af, and Ga. The primary habitat type is ATD, and the secondary habitat type is AVO.

139D—Trimountain-Paavola-Waiska complex, 8 to 15 percent slopes. These very deep, gently rolling and rolling soils are on knolls, ridges, and side slopes. The Trimountain and Paavola soils are moderately well drained, and the Waiska soil is excessively drained. Individual areas are irregular in shape and range from 30 to 200 acres in size. They are 40 to 55 percent Trimountain soil, 20 to 40 percent Paavola soil, and 15 to 30 percent Waiska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are small areas

of the somewhat poorly drained Net soils in depressions and drainageways. Also included are scattered small areas of the somewhat excessively drained Kalkaska and well drained Keweenaw soils in landscape positions similar to those of the Trimountain, Paavola, and Waiska soils. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. It is very rapid in the Waiska soil. The Trimountain and Paavola soils have a perched seasonal high water table at a depth of 1 to 2 feet in spring and in other excessively wet periods. The available water capacity is low in the Trimountain soil and very low in the Paavola and Waiska soils. Runoff is slow on all three soils.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is limited in spring and in other excessively wet periods on the Trimountain and Paavola soils. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. The slope limits the number of suitable landing sites. Landings can be established in small nearly level areas, if any are available, or in the nearly level adjacent areas. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. On year-round logging roads, a gravel base is needed.

Because of droughtiness, seedling mortality is a problem on the Paavola and Waiska soils. Furrowing or bedding before trees are planted helps to reduce the seedling mortality rate. Because of the very firm layer in the subsoil of the Trimountain and Paavola soils, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Trimountain and Paavola soils is 3W, and that assigned to the Waiska soil is 3S. The land capability classification of all three soils is VIs. The Michigan soil management groups are 3a-af, Ga/3-af, and Ga. The primary habitat type is ATD, and the secondary habitat type is AVO.

139E—Trimountain-Paavola-Waiska complex, 15 to 35 percent slopes. These very deep, hilly and steep soils are on hills and side slopes. The Trimountain and Paavola soils are well drained, and the Waiska soil is excessively drained. Individual areas are irregular in shape and range from 5 to 77 acres in size. They are 40 to 55 percent Trimountain soil, 20 to 40 percent Paavola soil, and 15 to 30 percent Waiska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The

substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Net soils in depressions and drainageways. Also included are scattered small areas of the somewhat excessively drained Kalkaska and well drained Keweenaw soils in landscape positions similar to those of the Trimountain, Paavola, and Waiska soils. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. It is very rapid in the Waiska soil. The available water capacity is low in the Trimountain soil and very low in the Paavola and Waiska soils. Runoff is medium on all three soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the slope. Special care is needed in laying out roads and landings and in operating equipment. Logging roads can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The number of suitable landing sites is minimal. Landings can be established in small nearly level areas, if any are available, and in the nearly level adjacent areas. The use of equipment is briefly restricted in spring and in other excessively wet periods on the Trimountain and Paavola soils. Unsurfaced roads are slippery, and ruts form easily. Year-round logging roads should be graveled. Erosion results from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, building logging roads on the contour or on the gentler slopes, and seeding logging roads, skid trails, and landings after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling mortality is a problem on the Paavola and Waiska soils. Furrowing or bedding before trees are planted helps to reduce the seedling mortality rate. Because of the very firm layer in the subsoil of the Trimountain and Paavola soils, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management groups are 3a-af, Ga/3-af, and Ga. The primary habitat type is ATD, and the secondary habitat type is AVO.

140B—Trimountain-Paavola-Waiska complex, dissected, 1 to 12 percent slopes. These very deep, nearly level to moderately sloping soils are on dissected uplands. The Trimountain and Paavola soils are moderately well drained, and the Waiska soil is excessively drained. The parallel ravines are 5 to 15 feet deep and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregularly shaped or elongated and range from 15 to 1,000 acres in size. They are 35 to 55 percent Trimountain soil, 15 to 45 percent Paavola soil, and 15 to 30 percent Waiska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, mottled, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, mottled, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, mottled, firm gravelly loamy

fine sand mixed with gravelly fine sandy loam; and reddish brown, mottled, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are some ravines that are 15 to 30 feet deep and 50 to 100 feet wide. The ravines have moderately steep to very steep side slopes. Also included are scattered small areas of the somewhat excessively drained Kalkaska and well drained Keweenaw soils in landscape positions similar to those of the Trimountain, Paavola, and Waiska soils. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. It is very rapid in the Waiska soil. The Trimountain and Paavola soils have a perched seasonal high water table at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is medium on the sides of the ravines and slow between the ravines. The available water capacity is low in the Trimountain soil and very low in the Paavola and Waiska soils.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In these areas, however, the use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil in the Trimountain and Paavola soils is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. On year-round logging roads, a gravel base is needed. The erosion hazard is moderate if the side slopes of the ravines are disturbed. Building logging roads and skid trails in the less sloping areas between the ravines or diagonally across the side slopes helps to prevent excessive soil loss. The best sites for landings are the nearly level areas between the ravines.

Because of droughtiness, seedling mortality is a problem on the Paavola and Waiska soils. Furrowing or bedding before trees are planted helps to reduce the seedling mortality rate. Because of the seasonal high water table and the firm layer in the lower part of the subsoil in the Trimountain and Paavola soils, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Trimountain and Paavola soils is 3W, and that assigned to the Waiska soil is 3S. The land capability classification of all three soils is IVe. The Michigan soil management groups are 3a-af, Ga/3-af, and Ga. The primary habitat type is ATD, and the secondary habitat type is AVO.

140D—Trimountain-Paavola-Waiska complex, dissected, 8 to 35 percent slopes. These very deep, moderately sloping to steep soils are on dissected uplands. The Trimountain and Paavola soils are well drained, and the Waiska soil is excessively drained. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The ravines are dominantly parallel, 10 to 35 feet deep, and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 10 to 40 feet wide. Some have seasonal streams. Individual areas of these soils are irregularly shaped or elongated and range from 10 to 200 acres in size. They are 35 to 55 percent Trimountain soil, 20 to 45 percent Paavola soil, and 15 to 30 percent Waiska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy

loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are scattered small areas of the somewhat excessively drained Kalkaska and well drained Keweenaw soils in landscape positions similar to those of the Trimountain, Paavola, and Waiska soils. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. It is very rapid in the Waiska soil. Runoff is medium on the sides of the ravines and slow between the ravines. The available water capacity is low in the Trimountain soil and very low in the Paavola and Waiska soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. In these areas, however, the use of equipment is briefly restricted in spring and in other excessively wet periods. When the Trimountain and Paavola soils are wet, unsurfaced roads tend to be slippery and ruts form easily. On year-round logging roads, a gravel base is needed. The number of suitable landing sites is limited because of the slope and the ravines. A few gently sloping areas may be available for use as landing sites.

If the side slopes of the ravines are disturbed, erosion is a moderate or severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding the roads after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling mortality is a problem on the Paavola and Waiska soils. Furrowing or bedding before trees are planted helps to reduce the seedling mortality rate. Because of the firm layer in the lower part of the subsoil in the Trimountain and Paavola soils, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management groups are 3a-af, Ga/3-af, and Ga. The primary habitat type is ATD, and the secondary habitat type is AVO.

140E—Trimountain-Paavola-Waiska complex, dissected, 15 to 60 percent slopes. These very deep, moderately steep to very steep soils are on dissected uplands. The Trimountain and Paavola soils are well drained, and the Waiska soil is excessively drained. Ridgetops are dominantly moderately steep or steep and are 15 to 100 feet wide. The parallel ravines are dominantly dendritic, 15 to 60 feet deep, and 40 to 150 feet wide and have very steep side slopes. The ravine bottoms are 15 to 45 feet wide. Some have seasonal

streams. Individual areas of these soils are irregularly shaped or elongated and range from 17 to 143 acres in size. They are 35 to 55 percent Trimountain soil, 20 to 45 percent Paavola soil, and 15 to 30 percent Waiska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Trimountain soil has about 1 inch of black, decomposed forest litter on the surface. The surface layer is dark reddish gray cobbly fine sandy loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark reddish brown, very friable fine sandy loam and reddish brown, friable gravelly fine sandy loam; the next part is reddish brown, firm, mixed gravelly loamy fine sand and gravelly fine sandy loam; and the lower part is reddish brown, firm gravelly loamy sand. The substratum to a depth of about 80 inches is reddish brown gravelly fine sand and extremely gravelly coarse sand.

Typically, the Paavola soil has about 2 inches of undecomposed forest litter on the surface. The surface layer is dark reddish brown gravelly coarse sandy loam about 4 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark reddish brown, very friable extremely gravelly coarse sand; dark brown, friable extremely gravelly coarse sand; dark reddish gray and reddish brown, firm gravelly loamy fine sand mixed with gravelly fine sandy loam; and reddish brown, very firm gravelly sandy loam. The substratum to a depth of about 70 inches is reddish brown, firm very gravelly sandy loam.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are scattered small areas of the somewhat excessively drained Kalkaska and well drained Keweenaw soils in landscape positions similar to those of the Trimountain, Paavola, and Waiska soils. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Trimountain soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderate to very rapid in the upper part of the Paavola soil, very slow in the next part, and moderate to very rapid in the lower part. It is very rapid in the Waiska soil. Runoff is medium on the sides of the ravines and slow between the ravines. The available water capacity is low in the Trimountain soil and very low in the Paavola and Waiska soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Access is easiest on the ridgetops and on the ravine bottoms. The use of equipment is briefly limited in spring and in other excessively wet periods on the Trimountain and Paavola soils. When the soils are wet, unsurfaced logging roads are slippery and ruts form easily. On year-round logging roads, a gravel base is needed. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling mortality is a problem on the Paavola and Waiska soils. Furrowing or bedding before trees are planted helps to reduce the seedling mortality rate. Because of the firm layer in the lower part of the subsoil in the Trimountain and Paavola soils, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the very steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 3a-af, Ga/3-af, and Ga. The primary habitat type is ATD, and the secondary habitat type is AVO.

142F—Keweenaw-Kalkaska-Waiska complex, dissected, 15 to 70 percent slopes. These very deep, moderately steep to very steep soils are on dissected uplands. The Keweenaw soil is well drained, the Kalkaska soil is somewhat excessively drained, and the Waiska soil is excessively drained. Ridgetops are dominantly moderately steep or steep and are 10 to 50 feet wide. The ravines are parallel or dendritic, 20 to 60 feet deep, and 50 to 250 feet wide and have very steep side slopes. The ravine bottoms are 10 to 45 feet wide. Some have seasonal streams. Individual areas of these soils are irregular in shape and range from 10 to 170 acres in size. They are 35 to 50 percent Keweenaw soil, 30 to 45 percent Kalkaska soil, and 15 to 30 percent Waiska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Keweenaw soil has a surface layer of black gravelly loamy sand about 2 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, very friable gravelly loamy sand; the next part is dark reddish brown and reddish brown, friable and very friable gravelly loamy sand; and the lower part is reddish brown, firm fine sandy loam and light reddish brown loamy fine sand. The substratum to a depth of about 60 inches is reddish brown loamy sand.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In places stratified, loamy or silty material is below a depth of 40 inches.

Typically, the Waiska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark reddish brown, very friable gravelly sand, and the lower part is dark brown, very friable very gravelly sand. The substratum to a depth of about 60 inches is yellowish brown extremely gravelly coarse sand and gravelly sand.

Included with these soils in mapping are small areas of the well drained Trimountain soils. Trimountain soils have a firm layer in the lower part of the subsoil. They are in landscape positions similar to those of the Keweenaw, Kalkaska, and Waiska soils. Also included are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms and areas of rock outcrop on the sides of the ravines. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the Keweenaw soil, rapid in the Kalkaska soil, and very rapid in the Waiska soil. The available water capacity is low in the Keweenaw and Kalkaska soils and very low in the Waiska soil. Runoff is slow on all three soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape and the slope. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Logging roads and skid trails should be established on the ridgetops or on the ravine bottoms. Loose sand in areas of the Keweenaw and Kalkaska soils can interfere with the traction of wheeled equipment during dry periods. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the contour, removing water with water bars, out-sloping or in-sloping road surfaces, and drop structures, and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the dissected landscape and the very steep side slopes of the ravines, however, site preparation and machine planting are difficult or impractical. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 4a-a, 5a, and Ga. The primary habitat type is ATD-D, and the secondary habitat type is TM.

144F—Graveraet-Kalkaska complex, dissected, 15 to 70 percent slopes. These very deep, moderately steep to very steep soils are on dissected uplands. The Graveraet soil is well drained, and the Kalkaska soil is

somewhat excessively drained. Ridgetops are dominantly moderately steep or steep and are 10 to 50 feet wide. The ravines are parallel or dendritic, 25 to 250 feet deep, and 45 to 660 feet wide and have very steep side slopes. The ravine bottoms are 25 to 150 feet wide. Many have seasonal streams. Individual areas of these soils are elongated or irregularly shaped and range from 5 to 1,500 acres in size. They are 40 to 75 percent Graveraet soil and 15 to 55 percent Kalkaska soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Graveraet soil has a surface layer of black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, firm fine sandy loam and reddish brown, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In places sandstone bedrock is within a depth of 40 inches.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are some areas where the ravine bottoms have exposures of bedrock. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. It is rapid in the Kalkaska soil. The available water capacity is low in both soils. Runoff is medium.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape and the slope. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines. Special logging methods, such as yarding the logs with a cable, may be needed. Logging roads and skid trails should be established on the ravine bottoms or on the ridgetops. Loose sand in areas of the Kalkaska soil can interfere with the traction of wheeled equipment during dry periods. Logging roads in areas of the Graveraet soil are slippery when wet. Suitable landing sites generally are not available because of the slope and the ravines.

Erosion is a severe hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building the logging roads and skid trails on the contour, removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, and seeding disturbed areas after the trees are logged help to prevent excessive soil loss. Cable logging from the ridgetops minimizes disturbance of the side slopes.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska soil. Because of the dissected landscape and the very steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Trees on the Graveraet soil are shallow rooted because of the firm layer in the lower part of the subsoil. Some may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIIe. The Michigan soil management groups are 2.5a-af and 5a. The primary habitat type is ATD, and the secondary habitat type is AVO.

145B—Kalkaska-Halfaday sands, 0 to 8 percent slopes. These very deep soils are on broad plains. The nearly level and undulating, somewhat excessively drained Kalkaska soil is on low knolls and ridges. The nearly level, moderately well drained Halfaday soil is in depressions and drainageways. Individual areas of these soils are irregular in shape and range from 10 to 120 acres in size. They are 45 to 60 percent Kalkaska soil and 20 to 35 percent Halfaday soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper

part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In some places layers of gravelly sand are in the substratum. In other places loamy or silty material is below a depth of 40 inches.

Typically, the Halfaday soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is pinkish gray sand about 3 inches thick. The subsoil is dark reddish brown, yellowish red, and strong brown, friable sand about 27 inches thick. The substratum to a depth of about 60 inches is light brown and reddish brown, mottled sand. In places the mottles are closer to the surface. In some areas the soil is fine sand throughout. In other areas loamy or silty material is below a depth of 40 inches.

Included with these soils in mapping are small areas of the poorly drained Roscommon soils in depressions and drainageways. These included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Kalkaska and Halfaday soils. The Halfaday soils have a seasonal high water table at a depth of 2.0 to 3.5 feet in spring and in other excessively wet periods. The available water capacity is low in both soils. Surface runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3S. The land capability classification is IVs. The Michigan soil management group is 5a. The primary habitat type is ATD-D, and the secondary habitat type is TM.

146—Cathro-Gay mucks. These very deep, nearly level soils are in depressions and drainageways. The Cathro soil is very poorly drained, and the Gay soil is poorly drained. These soils are subject to ponding. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are 40 to 60 percent Cathro soil and 20 to 45 percent Gay soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Cathro soil has a surface layer of black muck about 9 inches thick. The next 37 inches is black and very dark grayish brown muck. The substratum to a depth of about 60 inches is dark grayish brown fine sandy loam. In some places the substratum is sand or loamy sand. In other places the muck layer is less than 16 inches thick.

Typically, the surface layer of the Gay soil is about 5 inches of black muck over 3 inches of black mucky sandy loam. The subsoil is reddish brown, mottled, friable sandy loam about 16 inches thick. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some areas the soil has strata of finer textured material. In other areas the subsoil is loamy sand. In places the substratum is calcareous.

Included with these soils in mapping are small areas of the moderately well drained Munising soils on knolls and ridges. These included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the mucky layers of the Cathro soil and moderate or moderately slow in the substratum. It is moderate in the Gay soil. The seasonal high water table is near or above the surface of both soils in spring and in other excessively wet periods. The available water capacity is high in the Cathro soil and moderate in the Gay soil. Runoff is very slow or ponded.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on these mucky soils. Special harvesting equipment is needed. Access is easiest during periods in winter when roads are frozen. The number of suitable landing sites is severely limited because of the wetness.

Because of the wetness and the organic surface layer, seedling losses can be more than 50 percent. Because of the wetness, trees on these soils are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the

undesirable plants. Trees generally are not planted on these soils because of the wetness, seedling mortality, and plant competition.

The woodland ordination symbol assigned to the Cathro soil is 5W, and that assigned to the Gay soil is 7W. The land capability classification of both soils is VIw. The Michigan soil management groups are M/3c and 3c. The primary habitat type is TTS, and the secondary habitat type is FI.

147B—Munising-Liminga-Alcona complex, 1 to 8 percent slopes. These very deep, nearly level and gently sloping soils are on broad plains. The Munising and Alcona soils are moderately well drained, and the Liminga soil is well drained. Individual areas are irregular in shape and range from 5 to 850 acres in size. They are 40 to 60 percent Munising soil, 20 to 40 percent Liminga soil, and 15 to 30 percent Alcona soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Munising soil has a surface layer of dark gray loamy fine sand about 2 inches thick. The subsurface layer is pinkish gray loamy fine sand about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark reddish brown and reddish brown, friable fine sandy loam, and the lower part is reddish brown and light reddish brown, mottled, firm sandy loam and loamy sand. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some places sandstone bedrock is at a depth of 20 to 40 inches. In other places the upper part of the subsoil is sand. In some areas the substratum is sandy.

Typically, the Liminga soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is light reddish brown fine sand about 10 inches thick. The subsoil is dark reddish brown, reddish brown, and yellowish red, very friable fine sand about 29 inches thick. The substratum to a depth of about 60 inches is reddish yellow fine sand.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, mottled, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, mottled, stratified fine sand, loamy fine sand, and fine sandy loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Richter and Skanee soils in depressions and drainageways. These included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Munising soil, very slow in the next part, and moderate in the lower part. It is rapid in the Liminga soil and moderate in the Alcona soil. In spring and in other excessively wet periods, the Munising soil has a perched seasonal high water table at a depth of 1 to 2 feet and the Alcona soil has one at a depth of 2.5 to 6.0 feet. The available water capacity is low in the Munising and Liminga soils and moderate in the Alcona soil. Runoff is slow on all three soils.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods on the Munising and Alcona soils because of the seasonal high water table. The upper part of the subsoil is saturated during these periods. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in heavily traveled areas of the Liminga soil can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. The best sites for landings are the nearly level areas.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Liminga soil. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate. Because of the seasonal high water table, the trees on the Alcona and Munising soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

This map unit is well suited to crops. The major management concerns are water erosion, seasonal wetness, droughtiness, and the organic matter content. Cover crops, close-growing crops, and grassed

waterways reduce the runoff rate and thus help to control erosion. Returning crop residue to the soils, applying a system of conservation tillage, and adding organic material increase the organic matter content and conserve moisture.

This map unit is well suited to pasture and hay. The major management concern is the low available water capacity. Proper stocking rates, rotation grazing, and restricted grazing during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Munising soil is 3W, that assigned to the Liminga soil is 3S, and that assigned to the Alcona soil is 3L. The land capability classification of all three soils is IIe. The Michigan soil management groups are 3a-af, 4a, and 3a-s. The primary habitat type is ATD.

148B—Graveraet-Ocqueoc-Kalkaska complex, dissected, 1 to 12 percent slopes. These very deep, nearly level to moderately sloping soils are on dissected uplands. The Graveraet and Ocqueoc soils are moderately well drained, and the Kalkaska soil is somewhat excessively drained. The parallel ravines are 50 to 300 feet apart, 5 to 15 feet deep, and 10 to 50 feet wide and have moderately sloping side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregularly shaped or elongated and range from 10 to 975 acres in size. They are 40 to 65 percent Graveraet soil, 15 to 35 percent Ocqueoc soil, and 15 to 30 percent Kalkaska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Graveraet soil has a surface layer of black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, mottled, firm fine sandy loam and reddish brown, mottled, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In some places the upper part of the subsoil is sand. In other places sandstone bedrock is within a depth of 40 inches.

Typically, the Ocqueoc soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish brown fine sand about 4 inches thick. The subsoil is about 24 inches thick. The upper part is dark reddish brown and dark brown, very friable fine sand, and the lower part is brown, mottled, very friable fine sand. The substratum to a depth of about 60 inches is stratified, reddish brown and brown, mottled very fine sandy loam, loamy fine sand, and loamy very fine sand.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In places layers of gravelly sand are in the substratum.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are small areas of the excessively drained Waiska soils on small ridges and knolls. Included soils make up about 10 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. It is rapid in the sandy upper part of the Ocqueoc soil and moderately slow in the loamy lower part. It is rapid in the Kalkaska soil. In spring and in other excessively wet periods, the Graveraet soil has a seasonal high water table at a depth of 1 to 2 feet and the Ocqueoc soil has one at a depth of 2.5 to 6.0 feet. The available water capacity is low in the Graveraet and Kalkaska soils and moderate in the Ocqueoc soil. Runoff is slow.

These soils are used as woodland. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest in the less sloping areas between the ravines. In these areas, however, the use of equipment is restricted in spring and in other excessively wet periods. During these periods the upper part of the subsoil is saturated in the Graveraet soil. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Loose sand in areas of the Ocqueoc and Kalkaska soils can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. The erosion hazard is moderate if the side slopes of the ravines are disturbed. Building logging roads and skid trails in the less sloping areas between the ravines or diagonally across the side slopes helps to prevent excessive soil loss. The best sites for landings are the nearly level areas between the ravines.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Kalkaska and Ocqueoc soils. Planting containerized seedlings or special planting stock can reduce these losses. Because of the firm layer in the subsoil, trees on the Graveraet soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Some areas of this unit are used as hayland or pasture. The major management concern is the low available water capacity. Proper stocking rates, rotation grazing, and restricted grazing during excessively dry periods help to keep the pasture in good condition.

The woodland ordination symbol assigned to the Graveraet soil is 3W, and that assigned to the Kalkaska and Ocqueoc soils is 3S. The land capability classification of all three soils is IIIe. The Michigan soil management groups are 2.5a-af, 4/2a, and 5a. The primary habitat type is ATD, and the secondary habitat type is AVO.

148D—Graveraet-Ocqueoc-Kalkaska complex, dissected, 8 to 35 percent slopes. These very deep, moderately sloping to steep soils are on dissected uplands. The Graveraet and Ocqueoc soils are well drained, and the Kalkaska soil is somewhat excessively drained. Ridgetops are dominantly moderately sloping or strongly sloping and are 25 to 200 feet wide. The ravines are parallel or dendritic, 10 to 35 feet deep, and 20 to 100 feet wide and have moderately steep or steep side slopes. The ravine bottoms are 5 to 20 feet wide. Some have seasonal streams. Individual areas of these soils are irregularly shaped or elongated and range from 10 to 975 acres in size. They are 40 to 65 percent Graveraet soil, 15 to 35 percent Ocqueoc soil, and 15 to 30 percent Kalkaska soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Graveraet soil has a surface layer of black loam about 2 inches thick. The subsoil is about 37 inches thick. The upper part is dark reddish brown and reddish brown, friable loam, and the lower part is light reddish brown, firm fine sandy loam and reddish brown, firm loam. The substratum to a depth of about 60 inches is reddish brown loam. In some places the upper part of the subsoil is sand. In other places sandstone bedrock is within a depth 40 inches.

Typically, the Ocqueoc soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish brown fine sand about 4 inches thick. The subsoil is about 24 inches thick. The upper part is dark reddish brown and dark brown, very friable fine sand, and the lower part is brown, very friable fine sand. The substratum to a depth of 60 inches is stratified, reddish brown and brown very fine sandy loam, loamy fine sand, and loamy very fine sand.

Typically, the Kalkaska soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray sand about 3 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown and dark brown and is very friable, and the lower part is strong brown and loose. The substratum to a depth of about 60 inches is brown sand. In places layers of gravelly sand are in the substratum.

Included with these soils in mapping are somewhat poorly drained and poorly drained, sandy and loamy soils on the ravine bottoms. Also included are small areas of the excessively drained Waiska soils on small ridges and knolls. Included soils make up about 10 percent of the unit.

Permeability is moderate in the upper part of the Graveraet soil, very slow in the next part, and moderate or moderately slow in the lower part. It is rapid in the sandy upper part of the Ocqueoc soil and moderately slow in the loamy lower part. It is rapid in the Kalkaska soil. The available water capacity is low in the Graveraet and Kalkaska soils and moderate in the Ocqueoc soil. Runoff is slow.

These soils are used as woodland. The equipment limitation, the erosion hazard, seedling mortality, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the dissected landscape. Access is easiest on the ridgetops. The use of equipment in these areas is briefly restricted in spring and in other excessively wet periods on the Graveraet soil. When the soils are wet, unsurfaced roads tend to be slippery and ruts form easily. Loose sand in areas of the Ocqueoc and Kalkaska soils can interfere with the traction of wheeled equipment during dry periods. On year-round logging roads, a gravel base is needed. The number of suitable landing sites is limited because of the slope and the ravines. A few gently sloping areas between the ravines may be available for use as landing sites.

If the side slopes of the ravines are disturbed,

erosion is a moderate hazard. It results from the concentration of runoff on logging roads and skid trails and in the tracks of wheeled equipment. Building logging roads and skid trails on the ridgetops, on the ravine bottoms, or diagonally across the side slopes and seeding the roads after the trees are logged help to prevent excessive soil loss.

Because of droughtiness, seedling losses can be as high as 25 to 50 percent on the Ocqueoc and Kalkaska soils. Planting containerized seedlings or special nursery stock can reduce these losses. Because of the firm layer in the subsoil, trees on the Graveraet soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Because of the dissected landscape and the moderately steep or steep side slopes of the ravines, site preparation and machine planting are difficult or impractical. Species composition can generally be managed by various cutting practices. Special harvest methods may be needed to control plant competition.

The woodland ordination symbol is 3R. The land capability classification is VIe. The Michigan soil management groups are 2.5a-af, 4/2a, and 5a. The primary habitat type is ATD, and the secondary habitat type is AVO.

150B—Richter-Alcona complex, 0 to 8 percent slopes. These very deep, nearly level and gently sloping soils are on small flats and broad plains. The somewhat poorly drained Richter soil is in depressions and drainageways, and the moderately well drained Alcona soil is on low knolls. Individual areas are irregular in shape and range from 5 to 185 acres in size. They are 45 to 60 percent Richter soil and 35 to 50 percent Alcona soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Richter soil has about 4 inches of black, well decomposed forest litter on the surface. The subsurface layer is pinkish gray, very fine sandy loam about 5 inches thick. The subsoil is about 36 inches thick and is friable and mottled. The upper part is brown very fine sandy loam; the next part is strong brown, stratified loamy very fine sand and loamy fine sand; and the lower part is brown and reddish brown, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is strong brown and brown, mottled, stratified fine sand and loamy fine sand.

Typically, the Alcona soil has a surface layer of dark reddish brown loamy fine sand about 3 inches thick. The subsurface layer is pinkish gray loamy fine sand about 3 inches thick. The subsoil is about 42 inches thick. The upper part is dark reddish brown and reddish brown, friable loamy fine sand, and the lower part is reddish brown, mottled, friable, mixed loamy fine sand and fine sandy loam. The substratum to a depth of about 60 inches is reddish brown, mottled, stratified fine sand, loamy fine sand, and fine sandy loam.

Included with these soils in mapping are small areas of the well drained Liminga soils. Also included are small areas of poorly drained, sandy and loamy soils in the lowest depressions. These included soils are in slightly elevated areas. They make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Richter soil and moderate in the Alcona soil. In spring and in other excessively wet periods, the seasonal high water table is at a depth of 0.5 foot to 1.5 feet in the Richter soil and 2.5 to 6.0 feet in the Alcona soil. The available water capacity is moderate in both soils. Runoff is slow.

These soils are used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is limited in fall and spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used during these periods. Deep ruts can expose tree roots and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. Year-round logging roads should be graveled. Culverts are needed to maintain the natural drainage system. The use of landing sites is restricted to dry periods. The landings should be stabilized, so that they can withstand the repeated use of heavy equipment. The areas of Alcona soils and included Liminga soils in the slightly higher landscape positions can be used as sites for landings.

Because of the seasonal high water table, seedling losses can be as high as 25 to 50 percent. Timely planting and selection of special planting stock can reduce these losses. In some areas bedding also reduces the seedling mortality rate. Because of the seasonal high water table, trees on these soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. If trees are planted, site preparation by mechanical or chemical means may be needed to

control the competing vegetation.

The woodland ordination symbol assigned to the Richter soil is 3W, and that assigned to the Alcona soil is 3L. The land capability classification is IIw. The Michigan soil management groups are 2.5b and 3a-s. The primary habitat type is TMC-D, and the secondary habitat type is ATD.

151B—Champion cobbly very fine sandy loam, 1 to 8 percent slopes. This very deep, nearly level and gently sloping, moderately well drained soil is on broad plains and low knolls. Individual areas are irregular in shape and range from 5 to 300 acres in size.

Typically, the Champion soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray cobbly very fine sandy loam about 4 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, friable cobbly very fine sandy loam and cobbly fine sandy loam; the next part is reddish brown, mottled, firm gravelly fine sandy loam; and the lower part is mixed brown and reddish brown, mottled, very firm gravelly loamy fine sand. The substratum to a depth of about 60 inches is brown gravelly loamy sand. In some places the surface layer is stony. In other places bedrock is within a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Net soils in depressions and drainageways. Also included are scattered small areas of the somewhat excessively drained Karlin soils. These soils do not have a seasonal high water table. They are in landscape positions similar to those of the Champion soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Champion soil, very slow in the next part, and moderate or moderately rapid in the lower part. A perched seasonal high water table is at a depth of 1 to 2 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low.

Most areas are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. The degree of saturation generally is higher on the lower part of the slopes. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soil is dry or has an adequate snow cover. On year-round logging roads, a gravel base is needed. The best sites for landings are the nearly level areas.

Because of the seasonal high water table and the firm layer in the lower part of the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3X. The land capability classification is VIs. The Michigan soil management group is 3a-af. The primary habitat type is ATD.

152B—Kallio cobbly very fine sandy loam, 1 to 8 percent slopes. This very deep, nearly level and gently sloping, moderately well drained soil is on low knolls and broad plains. Individual areas are irregular in shape and range from 100 to 400 acres in size.

Typically, the surface layer is black cobbly very fine sandy loam about 3 inches thick. The subsurface layer is reddish gray cobbly very fine sandy loam about 2 inches thick. The subsoil is about 31 inches thick. In sequence downward, it is dark reddish brown, friable very fine sandy loam; reddish brown, mottled, friable very fine sandy loam; reddish brown, mottled, firm, mixed very fine sandy loam and loam; and reddish brown, firm, mixed loam and very fine sandy loam. The substratum to a depth of about 60 inches is reddish brown loam. In some places the lower part of the subsoil and the substratum are gravelly fine sandy loam. In other places the soil does not have a subsurface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Alstad soils in depressions and drainageways. Also included are small areas of the well drained Watton soils in landscape positions similar to those of the Kallio soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Kallio soil, very slow in the next part, and moderately slow in the lower part. A perched seasonal high water table is at a depth of 0.5 foot to 1.5 feet in spring and in other excessively wet periods. Runoff is slow. The available water capacity is low.

Most areas are used as woodland. The equipment limitation, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted in spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. The degree of saturation generally is higher on the lower part of the slopes. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soil is dry or has an adequate snow cover. Year-round logging roads should be graveled. The best sites for landings are the nearly level areas.

Because of the extremely firm layer in the subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are the dominant species on this soil. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3W. The land capability classification is VIs. The Michigan soil management group is 3/2a-f. The primary habitat type is ATD.

153B—Champion-Karlin-Fence complex, 1 to 8 percent slopes. These very deep, nearly level and gently sloping soils are on broad plains and low knolls. The Champion and Fence soils are moderately well drained, and the Karlin soil is somewhat excessively drained. Individual areas are irregular in shape and range from 15 to 575 acres in size. They are 30 to 50 percent Champion soil, 20 to 40 percent Karlin soil, and 15 to 30 percent Fence soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Champion soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray cobbly very fine sandy loam about 4 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, friable cobbly very fine sandy loam and cobbly fine sandy loam; the next part is reddish brown, mottled, firm gravelly fine sandy loam; and the lower part is mixed brown and reddish brown, mottled, very firm gravelly loamy fine sand. The substratum to a depth of about 60 inches is brown gravelly loamy sand. In some places the surface layer is stony. In other places bedrock is within a depth of 20 to 40 inches. In some areas the lower part of the subsoil has more silt and clay.

Typically, the Karlin soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is dark gray fine sandy loam about 3 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown and brown, friable fine sandy loam, and the lower part is brown, loose sand. The substratum to a depth of about 60 inches is strong brown sand. In some places the surface layer and the upper part of the subsoil are sand.

Typically, the Fence soil has about 2 inches of black, partially decomposed forest litter on the surface. The surface layer is reddish brown, very fine sandy loam about 2 inches thick. The subsoil is friable very fine sandy loam about 40 inches thick. The upper part is reddish brown and brown, and the lower part is reddish brown and mottled. The substratum to a depth of about 60 inches is reddish brown silt loam and very fine sandy loam. In places the surface layer and the upper part of the subsoil are sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Net and poorly drained Witbeck soils in depressions on benches and flats. These included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Champion soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderately rapid in the upper part of the Karlin soil and rapid in the lower part. It is moderately slow in the Fence soil. The Champion soil has a perched seasonal high water table at a depth of 1 to 2 feet, and the Fence soil has one at a depth of 2 to 6 feet. The available water capacity is low in the Champion and Karlin soils and high in the Fence soil. Runoff is slow on all three soils.

Most areas are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. On year-round logging roads, a gravel base is needed. The best sites for landings are the nearly level areas.

Because of the seasonal high water table, trees on

the Champion and Fence soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Champion soil is 3X, that assigned to the Karlin soil is 3A, and that assigned to the Fence soil is 3L. The land capability classification of all three soils is VIs. The Michigan soil management groups are 3a-af, 4a, and 3a. The primary habitat type is ATD.

153D—Champion-Karlin-Fence complex, 8 to 15 percent slopes. These deep, gently rolling and rolling soils are on knolls and low ridges. The Champion and Fence soils are moderately well drained, and the Karlin soil is somewhat excessively drained. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are 30 to 45 percent Champion soil, 20 to 35 percent Karlin soil, and 20 to 30 percent Fence soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Champion soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray cobbly very fine sandy loam about 4 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, friable cobbly very fine sandy loam and cobbly fine sandy loam; the next part is reddish brown, mottled, firm gravelly fine sandy loam; and the lower part is mixed brown and reddish brown, mottled, very firm gravelly loamy fine sand. The substratum to a depth of about 60 inches is brown gravelly loamy sand. In some places the surface layer is stony. In other places bedrock is within a depth of 20 to 40 inches. In some areas the lower part of the subsoil has more silt and clay.

Typically, the Karlin soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is dark gray fine sandy loam about 3 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown and brown, friable fine sandy loam, and the lower part is brown, loose sand. The substratum to a depth of about 60 inches is strong brown sand. In some places the surface layer and the upper part of the subsoil are sand.

Typically, the Fence soil has about 2 inches of black, partially decomposed forest litter on the surface. The surface layer is reddish brown very fine sandy loam about 2 inches thick. The subsoil is friable very fine sandy loam about 40 inches thick. The upper part is reddish brown and brown, and the lower part is reddish brown and mottled. The substratum to a depth of about 60 inches is reddish brown silt loam and very fine sandy loam. In places the surface layer and the upper part of the subsoil are sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Net and poorly drained Witbeck soils in depressions on benches and flats. These included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Champion soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderately rapid in the upper part of the Karlin soil and rapid in the lower part. It is moderately slow in the Fence soil. The Champion soil has a perched seasonal high water table at a depth of 1 to 2 feet, and the Fence soil has one at a depth of 2 to 6 feet. The available water capacity is low in the Champion and Karlin soils and high in the Fence soil. Runoff is slow or medium on all three soils.

These soils are used as woodland. The major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. The lower slopes and the included soils on small flats and benches remain wet for longer periods than the more sloping areas. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts can restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soils are dry or have an adequate snow cover. On all-weather logging roads, a gravel base is needed. The slope limits the number of suitable landing sites. Landings can be established in the small nearly level areas, if any are available, or in the nearly level adjacent areas.

Because of the seasonal high water table, trees on the Champion and Fence soils are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that

invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol assigned to the Champion soil is 3X, that assigned to the Karlin soil is 3A, and that assigned to the Fence soil is 3L. The land capability classification of all three soils is VIs. The Michigan soil management groups are 3a-af, 4a, and 3a. The primary habitat type is ATD.

153E—Champion-Karlin-Fence complex, 15 to 35 percent slopes. These very deep, hilly and steep soils are on hills and side slopes. The Champion and Fence soils are well drained, and the Karlin soil is somewhat excessively drained. Individual areas are irregular in shape and range from 5 to 150 acres in size. They are 35 to 50 percent Champion soil, 20 to 30 percent Karlin soil, and 15 to 25 percent Fence soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Champion soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is reddish gray cobbly very fine sandy loam about 4 inches thick. The subsoil is about 45 inches thick. The upper part is dark reddish brown, friable cobbly very fine sandy loam and cobbly fine sandy loam; the next part is reddish brown, firm gravelly fine sandy loam; and the lower part is mixed brown and reddish brown, very firm gravelly loamy fine sand. The substratum to a depth of about 60 inches is brown gravelly loamy sand. In some places the surface layer is stony. In other places bedrock is within a depth of 20 to 40 inches. In some areas the lower part of the subsoil has more silt and clay.

Typically, the Karlin soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is dark gray fine sandy loam about 3 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown and brown, friable fine sandy loam, and the lower part is brown, loose sand. The substratum to a depth of about 60 inches is strong brown sand. In places the surface layer and the upper part of the subsoil are sand.

Typically, the Fence soil has about 2 inches of black, partially decomposed forest litter on the surface. The surface layer is reddish brown, very fine sandy loam about 2 inches thick. The subsoil is friable very fine sandy loam about 40 inches thick. The upper part is reddish brown and brown, and the lower part is reddish brown. The substratum to a depth of about 60 inches is reddish brown silt loam and very fine sandy loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Net and poorly drained Witbeck soils in depressions on benches and flats. These included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Champion soil, very slow in the next part, and moderate or moderately rapid in the lower part. It is moderately rapid in the upper part of the Karlin soil and rapid in the lower part. It is moderately slow in the Fence soil. The available water capacity is low in the Champion and Karlin soils and high in the Fence soil. Runoff is medium on all three soils.

These soils are used as woodland. The equipment limitation, the erosion hazard, the windthrow hazard, and plant competition are management concerns. The use of equipment is restricted by the slope. Special care is needed in laying out roads and landings and in operating equipment. Roads can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The number of suitable landing sites is minimal. Landings can be established in small nearly level areas, if any are available, and in the nearly level adjacent areas. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soils are wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Erosion results from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures, building logging roads on the contour or on the gentler slopes, and seeding the logging roads, skid trails, and landings after the trees are logged help to prevent excessive soil loss.

Because of the firm layer in the lower part of the subsoil, trees on the Champion soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Northern hardwoods are dominant on these soils. Species composition can be managed by various cutting practices. Undesirable plants that invade clear-cut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The woodland ordination symbol is 3R. The land capability classification is VIIs. The Michigan soil management groups are 3a-af, 4a, and 3a. The primary habitat type is ATD.

154B—Vilas-Rubicon complex, 0 to 6 percent slopes. These very deep, nearly level and undulating, excessively drained soils are on broad plains and long side slopes. Individual areas are irregular in shape and range from 5 to 300 acres in size. They are 45 to 60 percent Vilas soil and 35 to 50 percent Rubicon soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Vilas soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown loamy sand about 2 inches thick. The subsoil is about 33 inches thick. The upper part is dark brown and strong brown, very friable loamy sand, and the lower part is strong brown, very friable sand. The substratum to a depth of about 60 inches is brown sand. In places the upper part of the subsoil is fine sandy loam.

Typically, the Rubicon soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is brown sand about 4 inches thick. The subsoil is dark brown and brown, very friable sand about 24 inches thick. The substratum to a depth of about 60 inches is light brown sand. In places it is gravelly sand.

Permeability is rapid in the upper part of the Vilas soil and rapid or very rapid in the lower part. It is rapid in the Rubicon soil. The available water capacity is low in both soils. Runoff is very slow.

Most areas are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The best sites for landings are the nearly level areas. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soil is moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

The woodland ordination symbol assigned to the Vilas soil is 6A, and that assigned to the Rubicon soil is 4S. The land capability classification of both soils is IVs. The Michigan soil management groups are 4a and 5.3a. The primary habitat type is AQVac, and the secondary habitat type is TMV.

154E—Vilas-Rubicon complex, 10 to 35 percent slopes. These very deep, gently rolling to steep, excessively drained soils are on knolls, ridges, and long side slopes. Individual areas are irregular in shape and range from 5 to 300 acres in size. They are 45 to 60 percent Vilas soil and 35 to 50 percent Rubicon soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Vilas soil has about 1 inch of black, partially decomposed forest litter on the surface. The surface layer is brown loamy sand about 2 inches thick. The subsoil is about 33 inches thick. The upper part is dark brown and strong brown, very friable loamy sand, and the lower part is strong brown, very friable sand. The substratum to a depth of about 60 inches is brown sand. In places the upper part of the subsoil is fine sandy loam.

Typically, the Rubicon soil has about 1 inch of black, well decomposed forest litter on the surface. The surface layer is brown sand about 4 inches thick. The subsoil is dark brown and brown, very friable sand about 24 inches thick. The substratum to a depth of about 60 inches is light brown sand. In places it is gravelly sand.

Permeability is rapid in the upper part of the Vilas soil and rapid or very rapid in the lower part. It is rapid in the Rubicon soil. The available water capacity is low in both soils. Runoff is slow.

Most areas are used as woodland. The major management concerns are the equipment limitation, the erosion hazard, and seedling mortality. The slope and loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. The slope also limits the number of suitable sites for logging roads and landings. Logging roads and skid trails can be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. Landings can be established in small nearly level areas, if any are available. Erosion results from the concentration of runoff on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures helps to prevent excessive soil loss. Because of droughtiness, seedling losses can be as high as 25 to 50 percent. Planting when the soils are moist can reduce these losses. Planting containerized seedlings or special nursery stock also reduces the seedling mortality rate.

The woodland ordination symbol assigned to the Vilas soil is 6R, and that assigned to the Rubicon soil is

4R. The land capability classification of both soils is VIIs. The Michigan soil management groups are 4a and 5.3a. The primary habitat type is AQVac, and the secondary habitat type is TMV.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 3,900 acres in the survey area, or about 0.8 percent of the total acreage, meets the soil requirements for prime farmland. The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1982, approximately 18,722 acres was used for crops and pasture. About 7,969 acres was used for hay crops, 140 acres was used for corn, and 1,750 acres was used for small grains. The remaining acreage was used for specialty crops or as pasture *(10)*.

Field crops commonly grown in the county are birdsfoot trefoil, red clover, alfalfa, bromegrass, oats, timothy, corn, and barley. Small acreages are used for strawberries, blueberries, sunflowers, raspberries, potatoes, cabbage, broccoli, and asparagus. Some birdsfoot trefoil is grown for seed, and the county has a few small apple orchards.

The annual number of frost-free days ranges from about 70 in the southwest corner of the county to about 140 along Lake Superior *(13)*. Because of the cold air coming off the lake, colder spring temperatures delay the blossoming of fruit trees and thus reduce the frost hazard. Crops that are adapted to short, cool growing seasons and to the strongly acidic soils in Houghton County should be selected. The crops that have potential for local and specialized markets include cabbage, broccoli, peas, spinach, buckwheat, apples,

plums, pears, cherries, parsley, cranberries, raspberries, blackberries, blueberries, asparagus, rhubarb, and various herbs.

Careful selection of crop varieties and of growing sites should include consideration of such soil conditions as water-holding capacity, drainage, maximum sun exposure, southern aspect, and cold air drainage.

Crop production in the county could be increased by applying soil and water conservation practices and by extending the latest crop production technology to all the farmland in the county. This soil survey can help to determine the conservation practices needed.

The main management concerns for crops in the county are soil acidity, low fertility, the hazard of erosion, wetness, droughtiness, frost hazard, tilth, and the short, cool growing season.

Many of the soils in Houghton County are acid and are low in natural fertility. Applications of lime in conjunction with a well managed fertilizer program can overcome these limitations. On all soils the amount of lime and fertilizer should be based on the results of laboratory soil tests, on the needs of the crops, and on the expected level of yields *(11)*. The Cooperative Extension Service can help to determine the amount to be applied.

Erosion is a hazard on some of the soils in the survey area. It reduces productivity by removing the surface layer, which contains most of the available plant nutrients and organic matter in the soil. Erosion on farmland can result in the pollution of streams and lakes by sediment, fertilizer, and pesticides. Sediment from erosion can clog culverts and drainage ditches and can destroy fish habitat. Erosion-control measures provide a protective cover, reduce the runoff rate, increase the rate of infiltration, and help to prevent the deposition of sediment in waterways.

The erodibility of a soil is dependent upon the surface texture, the length of slope, and the slope gradient. Generally, as the slope increases, the hazard of water erosion also increases. Soils with clayey, silty, and loamy textures are more susceptible to water erosion than sandy textured soils. In Houghton County the soils most susceptible to water erosion are Froberg silt loam, Graveraet loam, Munising loamy fine sand, Nunica silt loam, Ontonagon silt loam, Trimountain cobbly fine sandy loam, and Watton loam.

Conservation tillage or minimum tillage systems leave a protective cover of crop residue on the surface. These systems include crop rotations that maintain the thickness of the topsoil. Crop residue management also maintains or increases the thickness of the topsoil. Some species and varieties of plants and some fertilizers produce larger quantities of crop residue. For example, grasses and grains produce more residue than legumes.

Green manure crops are grown for the purpose of increasing fertility and the content of organic matter. They are incorporated into the soil while still green. Red clover and rye grass are commonly used as green manure crops. Any crop that is easily established, grows rapidly, and is easily incorporated into the soil may be used as green manure. Planting legumes in conjunction with the green manure crop can add nitrogen to the soil, which reduces the need for nitrogen fertilizer.

Cover crops are seeded during final cultivation of a crop. After the main crop is harvested, the cover crop serves as winter cover for erosion control and retains nutrients that otherwise might be leached downward into the soil. The cover crop should have a sufficient growth period to allow the plants to reach maturity after the cash crop is removed.

Animal manure applications can increase the thickness of the topsoil, the content of organic matter, and fertility. To prevent surface water contamination, excessive amounts of agricultural waste should not be applied on land that slopes towards streams. Excessive application rates can also result in the contamination of ground water.

Contour stripcropping alternates strips of row crops with strips of grass-legume hay or small grain. The strips are planted on the contour or across the path of the prevailing winds.

Grassed waterways are used to prevent gully formation in areas where water is transported down a slope in a concentrated flow. Subsurface drainage tiles can be installed beneath the waterway to remove excess water. This internal drainage enhances vegetative growth in the waterway and provides drier conditions for crossing with equipment during field operations. Rocked crossings also can be built across waterways to provide safe access to various fields.

Wind erosion can be a hazard on all unprotected soils, especially those with sandy surfaces, such as Alcona, Allendale, Au Gres, Croswell, Halfaday, Kalkaska, Liminga, Rubicon, Waiska, and Yalmer soils. Wind erosion can be a problem on the county's various "stamp sands," which are a result of mining activities. Drained and unprotected organic soils are likewise highly susceptible to wind erosion. Maintaining a vegetative cover, applying surface mulch, and establishing field windbreaks of adapted trees and shrubs planted at right angles to the prevailing winds

can protect the soils against wind erosion.

Soil drainage is a management concern because some soils are excessively wet as a result of a high water table. These wet soils are generally in low areas and in depressions. Equipment use, seed germination, and plant growth can be adversely affected unless the excess water is removed from these soils. These soils are also subject to low soil temperatures and a frost hazard, which can also hinder production.

Very poorly drained and poorly drained soils have a water table near or above the surface for most of the year and are usually impractical for crop production. Very poorly drained soils in Houghton County include those of the Cathro, Dawson, Loxley, Lupton, and Tawas series. These soils have thick accumulations of organic material, and in undrained areas they exhibit obvious wetland characteristics. Poorly drained soils include those of the Arnheim, Bergland, Gay, Kinross, Roscommon, and Witbeck series.

Somewhat poorly drained soils have a water table within 6 inches of the surface during excessively wet periods. Examples of soils in this category are those of the Au Gres, Alstad, Assinins, Net, Rudyard, Skanee, Sturgeon, and Zeba series.

Moderately well drained soils have a water table within 12 inches of the surface during excessively wet periods. These include Champion, Kallio, Keweenaw, Munising, Ontonagon, Paavola, Trimountain, and Yalmer soils that have slopes of less than 15 percent in non-dissected areas. Many of these soils have a restrictive, slowly permeable layer at a depth of about 24 inches. Small areas of wetter soils are commonly included with these soils.

The design of surface and subsurface drainage systems varies with the kind of soil and with other factors. Because of the frost hazard in areas of poorly drained and very poorly drained soils, most drainage improvements have been implemented in areas of somewhat poorly drained and moderately well drained soils. Surface drainage systems are often more cost effective than other systems. Improving natural waterways, removing drainage obstructions, and providing diversions to redirect surface runoff can greatly reduce drainage problems. Deeper drainage ditches are sometimes useful if an adequate outlet is available. Subsurface tile drainage systems also can be used to lower a water table; many of the soils in the survey area, however, have a fragipan that can interfere with the functioning of this type of drainage system. Information about the design of drainage systems is available in local offices of the Soil Conservation Service and of the various conservation districts.

Droughtiness is a management concern because it can decrease crop production. Because sandy soils have a low available water capacity, crops may wither during the summer unless they are irrigated or are drought tolerant. Examples of droughty soils in Houghton County are those of the Kalkaska, Liminga, Alcona, Deerton, Croswell, Halfaday, Keweenaw, Paavola, Yalmer, Rubicon, Vilas, and Waiska series. The moisture-holding capacity of these soils can be improved by increasing the content of organic matter.

The frost hazard can harm sensitive crops. Spring, fall, and occasional summer frosts occur as freezing air from higher altitudes travels downslope to the lowest areas and accumulates, which causes frost in the lowlands and on the flood plains.

The short, cool growing season limits the amount of time available for the crops to grow and mature. Cold soils inhibit seed germination. Slope aspect also has an important effect on soil temperature and crop growth. Land with a southern aspect will warm up considerably faster in the spring. Crops will germinate and grow faster because of increased sunlight and higher soil temperatures. South-facing slopes, however, also lose soil moisture and become droughty earlier during drier years. The effects of early germination and growth can be harmful to frost-sensitive plants.

Soil tilth is an important factor affecting the germination of seeds and their subsequent growth, the hazard of erosion, runoff rates, infiltration rates, and the amount of water available to crops. Soils with good tilth are granular and porous on the surface. Soils with poor tilth form a crust on the surface after intense rainfalls. Maintaining good tilth is difficult in areas of the clayey Ontonagon, Froberg, and Rudyard soils because these soils are sticky and plastic when wet and are slow to drain. If the soils are plowed when wet, they tend to become compacted and very cloddy when they dry. Soils with a loamy surface can also exhibit poor tilth unless organic matter is continually added. No-till pasture and hayland seeding can maintain good tilth and conserve existing soil moisture, thus improving growth conditions for the germinating grass/legume seedlings.

Soil compaction can result when machinery is operated on wet, loamy or clayey soils or if livestock are allowed to pasture on these soils. Productivity is reduced on compacted soils because of increased soil density, which inhibits root penetration, and decreased soil pore space in the root zone, which reduces the air and water available to roots.

Pasture management includes proper applications of fertilizer and lime. Amounts and frequency of

applications should be determined from laboratory testing. Pasture rotation, deferred grazing, adequate water supplies for livestock, and the maintenance of the key forage species are other pasture management measures. Many of the soils used as pasture are slowly permeable and are slow to dry in the spring and after heavy rains. Grazing these soils during wet periods causes compaction and reduces yields. If areas with better drainage are available, they should be used during wet periods. Key forage species include birdsfoot trefoil and bromegrass on medium textured, moderately well drained soils; alfalfa, red clover, bromegrass, and orchardgrass on coarse textured, well drained soils; and birdsfoot trefoil and reed canary grass on wet soils. Alfalfa requires a near neutral soil and may thrive in areas of Ontonagon and Graveraet soils because of an increased alkalinity at greater depths in these soils. The legumes in all pasture mixes require the application of the proper type and quantity of inoculant at planting so the nitrogen-forming bacteria will form root nodules.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(16)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table. Also given at the end of each map unit description is a Michigan soil management group *(12)*. The soils are assigned to a group according to the dominant profile texture, the natural drainage class, and the major management concerns. For soils making up a complex, the management groups are listed in the same order as the series named in the complex.

Woodland Management and Productivity

Dennis Robinson, technical representative, Michigan Department of Agriculture, helped prepare this section.

Woodland makes up about 534,000 acres, or about 82 percent of the county. Federal and state agencies control about 173,000 acres. Forest industry companies and other corporations own approximately 63 percent of the 321,000 acres of private woodland in the county. The remainder is in small, individually owned units.

Woodland is the dominant land use on all but a few soil types. Stands on upland soils are dominantly northern hardwoods, namely, sugar maple, red maple, basswood, yellow birch, and hemlock. Black cherry, balsam fir, and white spruce also are in some stands. Young, even-aged stands are mostly aspen and birch. Large areas support aspen or mixed northern hardwoods and aspen. Stands on the wetter soils are dominantly red maple, quaking aspen, paper birch, and white spruce.

Stands on soils in swamps are mostly balsam fir, black spruce, northern whitecedar, and tamarack. Red maple, quaking aspen, paper birch, and black ash are in some stands.

In 1980, the composition of the forest species, by forest type, was 5 percent pine, 10 percent spruce-fir and other conifers, 3 percent elm-ash and other lowland hardwoods, 68 percent maple-basswood-birch and other upland hardwoods, 13 percent aspen-birch, and 1 percent nonstocked areas *(18)*. By stand size, the composition was 41 percent sawtimber, 46 percent poletimber, 12 percent sapling and seedling stands, and 1 percent nonstocked areas. The growing stock had a volume of 718,181,000 cubic feet and an annual growth of 22,844,000 cubic feet. About 8,451,000 cubic feet was removed. Sawtimber had a volume of 1,995,226,000 board feet and an annual growth of 94,190,000 board feet. About 32,353,000 board feet was removed.

Soil erosion can occur as a result of site preparation and cutting if the soil is exposed along logging roads, skid roads, and fire lanes and in landing areas. Burned areas also are subject to erosion. Erosion is generally a hazard on forest land if the slope of the soil is 15 percent or more. About 75,000 acres of the forest land in the survey area is susceptible to erosion. This acreage includes some areas of Graveraet, Munising, and Trimountain soils. Building logging roads and skid roads on the contour minimizes erosion.

Soil wetness is the result of a high water table, flooding, or ponding. It causes seedling mortality, limits the use of equipment, increases the extent of undesirable plants following harvest, and increases the windthrow hazard by restricting the rooting depth of some trees.

Soils that have a perched water table make up approximately 215,000 acres, or about 45 percent of the survey area. They include the moderately well drained Munising, Paavola, and Trimountain soils and the somewhat poorly drained Skanee and Net soils. Ruts form easily if wheeled skidders are used when these soils are wet. Deep ruts tend to restrict lateral drainage, result in damage to tree roots, and alter soil structure. Also, they can result in a change in species composition and can reduce yields. Wetness also is a problem on about 52,000 acres of poorly drained or very poorly drained soils in the forested areas. These soils include Gay, Kinross, and Lupton soils. On all of the wet soils, equipment should be used only during dry periods or when the ground is frozen or has an adequate snow cover.

Soil droughtiness can cause seedling mortality. The steeper, south- and west-facing slopes can be especially droughty because of high soil temperatures

and the evaporation rate. Droughtiness is a problem on about 81,500 acres of forested soils. These include Croswell, Kalkaska, and Rubicon soils. Slopes are steep on about 20 percent of this acreage. Planting when the soils are moist can reduce the seedling mortality rate. Seedling survival during dry periods can be improved by planting large, vigorous nursery stock if natural regeneration is undesirable or insufficient. Special site preparation, such as furrowing to conserve moisture, may also be needed. Containerized planting stock may be needed on very dry sites.

Slope, stoniness, and *rock outcrops* can limit the use of forestry equipment. On about 75,000 acres in the survey area, a slope of 15 percent or more limits the use of equipment in logging areas, on skid roads, and on logging roads. Building the logging roads and skid roads on the contour helps to overcome this limitation. On very steep slopes, track-type harvesting equipment cannot be operated safely. Special systems are needed. The slope also affects the selection of sites for landings and log-handling areas. Nearly level and undulating areas are the best sites. Stones, rock outcrops, and a shallow depth to bedrock not only restrict the use of equipment but also hinder the construction of logging roads. Stoniness is a problem on about 11,000 acres of forest land in the survey area, rock outcrop is a problem on about 19,000 acres, and bedrock within a depth of 20 inches is a problem on about 1,500 acres. Careful planning of proposed logging roads can avoid most of these obstacles.

Soil productivity is dominantly high on the forest land in the survey area. The soils that have a high content of moisture may support an abundance of undesirable plants when openings are made in the tree canopy. These competing plants can hinder or prevent regeneration of the more desirable species. Competing vegetation can be controlled by suitable herbicides, by mechanical removal, or by a proper method of harvesting.

Tables 8 and 9 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. Table 8 lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol,* a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X,* stoniness or rockiness; *W,* excess water in or on the soil; *T,* toxic substances in the soil; *D,* restricted rooting depth; *C,* clay in the upper part of the soil; *S,* sandy texture; *F,* a high content of rock fragments in the soil; and *L,* low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal

high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand. The volume was determined through the use of standard yield tables *(19)*.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Table 9 gives information about operating harvesting or thinning equipment in logging areas and on skid roads, log landings, and logging roads. Limitations are given for the most limiting season and for the preferred season. The *most limiting season* in this survey area generally is spring or late fall. In some areas, however, it is during dry periods in summer, when loose sand can limit trafficability on deep, well drained, sandy soils.

The *preferred operating season* is the period when harvesting or thinning causes the least amount of soil damage. This period generally is when the soil is not too wet or when the ground is frozen or partly frozen or has an adequate snow cover.

In table 9 a rating of *slight* indicates that the use of conventional logging equipment is not restricted if normal logging methods are used. A rating of *moderate* indicates that the use of equipment is restricted because of one or more soil factors. If wetness is a limitation, high flotation equipment or special procedures may be needed to prevent the formation of ruts. A rating of *severe* indicates that the kind of equipment that can be used is seriously restricted.

Logging areas and skid roads include areas where some or all of the trees are being cut. Generally, equipment traffic is least intensive in the logging areas. Skid roads, which generally are within the logging area, are roads or trails over which the logs are dragged or hauled from the stump to a log landing.

Log landings are areas where logs are assembled for transportation. Wheeled equipment may be used more frequently in these areas than in any other areas affected by logging.

Haul roads are access roads leading from primary or surfaced roads to the logging areas. The logging roads serve as transportation routes for wheeled logging equipment and logging trucks. Generally, they are unpaved roads. Some are graveled.

Forest Habitat Types

The information in this section is derived from a field guide developed for the Upper Peninsula of Michigan and for northeast Wisconsin *(4)*. The system of habitat classification used in the guide is based on the concept that plants occur in predictable patterns or communities and that these communities reflect differences in site characteristics.

Besides identifying the various habitat types by means of vegetative keys, the guide also provides information about the different possible successional stages for most of the habitat types. The successional stages depend largely on how the forest has been disturbed. They include the succession after logging in the original climax stands, the succession after logging in second-growth stands, and the succession in stands that have been both logged and burned.

The guide gives the suggested forest management

for each of the successional stages. This management includes methods of thinning and harvest, site preparation, and measures that improve regeneration of the stands. The potential productivity, in terms of a site index and mean annual volume in cubic feet per acre per year, is given for most of the habitat types. The development of the descriptive or interpretive information for some of the habitat types, however, is based on limited data and thus should be used with caution.

Habitat types have been determined for each map unit in the survey area with the exception of miscellaneous areas, such as borrow pits. The primary habitat type is the one that is most common on the map unit. The secondary habitat type is less common. Habitat types are specified at the end of the descriptions in the section "Detailed Soil Map Units." They also are specified in the section "Interpretive Groups," which follows the tables at the back of this survey.

The following paragraphs describe the habitat types in the survey area. They provide information about the potential climax species, some of the common understory species, and if known, the potential productivity of the habitat type.

AQVac—Acer-Quercus-Vaccinium habitat type. This habitat type has a potential climax overstory dominated by red maple and northern red oak. Other species include eastern hemlock, eastern white pine, balsam fir, and white spruce. The dominant ground flora includes lowbush blueberry, Canada blueberry, brackenfern, wintergreen, bigleaf aster, and hazelnut. The potential productivity is moderately low for northern hardwoods, moderate for aspen, and moderately high for red pine and jack pine.

ATD—Acer-Tsuga-Dryopteris habitat type. This habitat type has a potential climax overstory dominated by sugar maple. Other species include eastern hemlock and American basswood. Yellow birch, red maple, and American elm are in some areas. The dominant ground flora includes spinulose woodfern, rosy twistedstalk, Solomons seal, scarlet elder, and Canada mayflower. The potential productivity is moderately high for northern hardwoods and high for aspen. The potential productivity for red pine plantations is high if plant competition is controlled.

ATD-CI—Acer-Tsuga-Dryopteris/Circaea-Impatiens phase habitat type. This habitat type has a potential climax overstory dominated by sugar maple. Other species include eastern hemlock and American basswood. Yellow birch, red maple, and American elm are in some areas. The dominant ground flora includes spinulose woodfern, rosy twistedstalk, Solomons seal, scarlet elder, Canada mayflower, jewelweed, and alpine circaea. The potential productivity is moderately high for northern hardwoods and high for aspen. The potential productivity for red pine plantations is high if plant competition is controlled.

ATD-D—Acer-Tsuga-Dryopteris/Dryopteris phase habitat type. This habitat type has a potential climax overstory dominated by sugar maple. Other species include eastern hemlock and American basswood. Yellow birch, red maple, and American elm are in some areas. The dominant ground flora includes spinulose woodfern, rosy twistedstalk, Solomons seal, scarlet elder, and Canada mayflower. The potential productivity is moderately high for northern hardwoods and high for aspen. The potential productivity for red pine plantations is high if plant competition is controlled.

AVO—Acer-Viola-Osmorhiza habitat type. This habitat type has a potential climax overstory dominated by sugar maple. Other species include American basswood, white ash, yellow birch, eastern hophornbeam, eastern hemlock, and American elm. The dominant ground flora includes Canada white violet, sweet cicely, spinulose woodfern, ladyfern, Solomons seal, and rosy twistedstalk. The potential productivity is high for northern hardwoods and aspen. It also is high for red pine plantations if plant competition is controlled.

AVO-CI—Acer-Viola-Osmorhiza/Circaea-Impatiens phase habitat type. This habitat type has a potential climax overstory dominated by sugar maple. Other species include American basswood, white ash, yellow birch, eastern hophornbeam, eastern hemlock, and American elm. The dominant ground flora includes Canada white violet, sweet cicely, spinulose woodfern, ladyfern, Solomons seal, rosy twistedstalk, jewelweed, and alpine circaea. The potential productivity is high for northern hardwoods and aspen. It also is high for red pine plantations if plant competition is controlled.

FI—Fraxinus-Impatiens habitat type. This habitat type has a potential climax overstory dominated by white ash and red maple. Other species include sugar maple, black ash, and balsam fir. The dominant ground flora includes jewelweed, sedge, alpine circaea, spinulose woodfern, ladyfern, scarlet elder, and field mint. The potential productivity for northern hardwoods is moderate.

FMC—Fraxinus-Mentha-Carex habitat type. This habitat type has a potential climax overstory dominated by black ash and American elm. Other species include red maple and balsam fir. The dominant ground flora includes sedge, field mint, speckled alder, and jewelweed.

PCS—Picea-Chamadaphne-Sphagnum habitat type. This habitat type has a potential climax overstory dominated by black spruce. Other species include tamarack and northern whitecedar. The dominant ground flora includes leatherleaf, bog rosemary, pale laurel, sphagnum, Labrador tea ledum, sedge, and Canada blueberry.

QAE—Quercus-Acer-Epigea habitat type. This habitat type has a potential climax overstory dominated by red oak and red maple. Other species are white spruce and eastern white pine. The dominant ground flora includes brackenfern, trailing arbutus, wintergreen, lowbush blueberry, mosses, and Canada blueberry. The potential productivity is moderately low for aspen and moderate for red pine and jack pine.

TAM-Eq—Tsuga-Acer-Mitchella/Equisetum phase habitat type. This habitat type has a potential climax overstory dominated by sugar maple and eastern hemlock. Other species include black ash, American elm, red maple, American basswood, white ash, and yellow birch. The dominant ground flora includes sedge, wild sarsaparilla, partridgeberry, horsetail, bigleaf aster, Canada mayflower, ladyfern, American fly honeysuckle, rosy twistedstalk, and northern dewberry. The potential productivity is moderately low for northern hardwoods and moderate for aspen.

TM—Tsuga Maianthemum habitat type. This habitat type has a potential climax overstory dominated by eastern hemlock, sugar maple, and red maple. Other species include yellow birch, white spruce, balsam fir, eastern white pine, northern red oak, northern whitecedar, and American basswood. The dominant ground flora includes Canada mayflower, brackenfern, sedge, American starflower, and wild sarsaparilla. The potential productivity is moderate for northern hardwoods, moderately high for aspen, and high for red pine and jack pine.

TMC—Tsuga-Maianthemum-Coptis habitat type. This habitat type has a potential climax overstory dominated by eastern hemlock and red maple. Sugar maple and yellow birch are common. Other species include balsam fir, white spruce, and northern whitecedar. The dominant ground flora includes Canada mayflower, goldthread, yellow beadlily, bunchberry dogwood, American starflower, and spinulose woodfern. The potential productivity is moderate for northern hardwoods and aspen.

TMC-D—Tsuga-Maianthemum-Coptis/Dryopteris phase habitat type. This habitat type has a potential climax overstory dominated by eastern hemlock and red maple. Sugar maple and yellow birch are common. Other species include balsam fir, white spruce, and northern whitecedar. The dominant ground flora includes Canada mayflower, goldthread, yellow beadlily, bunchberry dogwood, American starflower, spinulose woodfern, long beech fern, oakfern, and Solomons seal. The potential productivity is moderate for northern hardwoods and aspen.

TMC-V—Tsuga-Maianthemum-Coptis/Vaccinium phase habitat type. This habitat type has a potential climax overstory dominated by eastern hemlock and red maple. Sugar maple and yellow birch are common. Other species include balsam fir, white spruce, and northern whitecedar. The dominant ground flora includes Canada mayflower, goldthread, yellow beadlily, bunchberry dogwood, American starflower, Canada blueberry, lowbush blueberry, and spinulose woodfern. The potential productivity is moderate for northern hardwoods and aspen.

TMV—Tsuga-Maianthemum-Vaccinium habitat type. This habitat type has a potential climax overstory dominated by eastern hemlock and red maple. Other species include sugar maple, eastern white pine, balsam fir, white spruce, and northern red oak. The dominant ground flora includes Canada blueberry, wild sarsaparilla, brackenfern, Canada mayflower, lowbush blueberry, yellow beadlily, and wood betony. The potential productivity is moderate for northern hardwoods, moderately high for aspen, and high for red pine and jack pine.

TTL—Tsuga-Thuja-Lonicera habitat type. This habitat type has a potential climax overstory dominated by eastern hemlock and northern whitecedar. Other species include red maple, sugar maple, balsam fir, and eastern white pine. The dominant ground flora includes bigleaf aster, sedge, American fly honeysuckle, Canada mayflower, and spinulose woodfern. The potential productivity is moderately low for northern hardwoods, high for aspen, and moderate for red pine.

TTP—Tsuga-Thuja-Petasites habitat type. This habitat type has a potential climax overstory dominated by eastern hemlock and northern whitecedar. Other species include balsam fir, red maple, and sugar maple. The dominant ground flora includes palmate-leaved sweet coltsfoot, bigleaf aster, sedge, barren strawberry, northern dewberry, bunchberry dogwood, wild sarsaparilla, and black snakeroot. The potential productivity is moderately low for aspen.

TTS—Tsuga-Thuja-Sphagnum habitat type. This habitat type has a potential climax overstory dominated by eastern hemlock and northern whitecedar. Other species include balsam fir, black spruce, and red maple. The dominant ground flora includes sphagnum, goldthread, bunchberry dogwood, sedge, Canada

mayflower, American starflower, and wood sorrel.

Recreation

Houghton County has many campgrounds and parks along rivers and on the shores of Lake Superior and many inland lakes. It has numerous waterfalls and more than 20,899 acres of inland lakes and streams. The Ottawa National Forest is located in the extreme southern end of the county, and the Copper Country State Forest is in the central part. Recreational activities in the county include hiking, fishing, hunting, skiing, and snowmobiling. The streams in the county are noted for their trout, and Lake Superior is noted for lake trout and whitefish. The county also offers some of the best areas for Nordic skiing and snowmobiling in the Midwest.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Houghton County has a large and varied population of fish and wildlife. White-tailed deer, black bear, coyote, tree squirrels, snowshoe hare, hawks, owls, songbirds, and the bald eagle are common. The streams and lakes support northern pike, perch, walleye, largemouth bass, smallmouth bass, brook trout, rainbow trout, and panfish. A refuge for Canada geese and other waterfowl is maintained on the Sturgeon River Sloughs.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for

various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, rye, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are strawberry, dandelion, Solomons seal, jewelweed, and wild lily of the valley.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, aspen, cherry, maple, apple, raspberry, dogwood, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are nannyberry, autumn olive, Siberian crabapple, American cranberrybush, and silky dogwood.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and hemlock.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cattail, arrowhead, rushes, sedges, reeds, waterlily, and pickerelweed.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, potholes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include field mice, woodchuck, meadowlark, field sparrow, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include coyote, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, porcupine, raccoon, white-tailed deer, and black bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore

birds, muskrat, mink, beaver, and otter.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, diversions, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without

basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the

level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for

commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control water erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

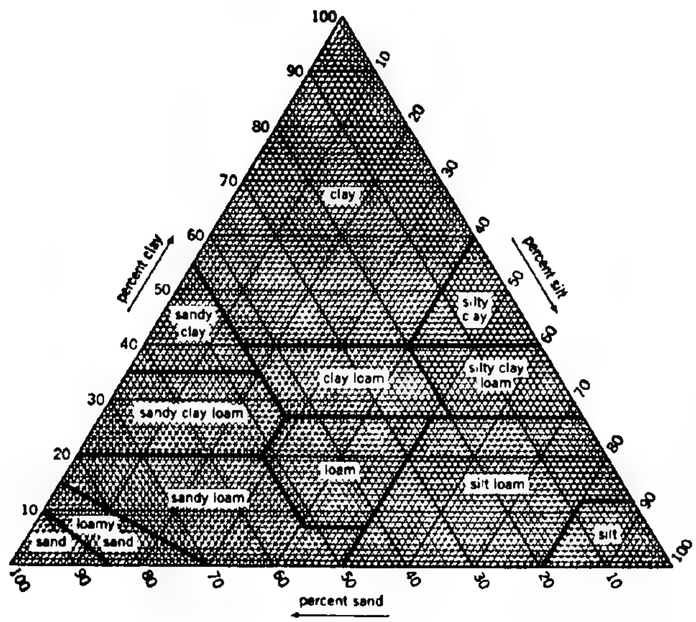

Figure 13.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 13). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified

as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available

water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can easily be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can easily be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settlement of organic soils or of

saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 18 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Characterization Data for Selected Soils

Some of the major soils in Houghton County were sampled by the Soil Research Laboratory, Michigan Technological University, Houghton, Michigan, and by the National Soil Survey Laboratory in Lincoln, Nebraska. The laboratory data obtained from the soil samples include analyses of particle-size distribution, coarse fragments, bulk density, and moisture retention. Complete chemical analyses were also performed on each sample, and spodic horizon criteria and fragipan criteria were determined on the appropriate samples. Standard National Cooperative Soil Survey procedures were used for all analyses. Forest sites also were sampled for an estimate of the productivity of many of the sampled soils for wood products.

These data were used in classifying and correlating the soils and in evaluating their behavior, especially under forestry uses. A total of 6 profiles were selected as representative of their respective series. These series and their laboratory identification numbers are as follows: Graveraet (S85-MI-061-2 and S85-MI-061-3), Liminga (S85-MI-061-4), Munising (S85-MI-061-1), Paavola (S86-MI-061-1), and Trimountain (S86-MI-061-2).

In addition to the Houghton County data, soil characterization data and forest site data are available from nearby counties having many of the same soils that were not sampled in Houghton County. These data and the Houghton County data are available at the Soil Research Laboratory, Michigan Technological University, Houghton, Michigan; the Soil and Water Conservation Division, Michigan Department of Agriculture, Lansing, Michigan; and the Soil Conservation Service, State Office, East Lansing, Michigan.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(17)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Spodosol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthod (*Orth*, meaning the common ones, plus *od*, from Spodosol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fragiorthods (*Fragi*, meaning fragipan, plus *orthod*, the suborder of the Spodosols that has a horizon characterized by an accumulation of aluminum, iron, and organic carbon in which no one of the elements dominates).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fragiorthods.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, frigid Typic Fragiorthods.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (15)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (17)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Abbaye Series

The Abbaye series consists of moderately deep, moderately well drained and well drained, moderately permeable soils on till plains and sandstone benches. These soils formed in loamy and sandy glacial till over sandstone bedrock. Slopes range from 1 to 70 percent.

Typical pedon of Abbaye loamy fine sand, in an area of Abbaye-Munising loamy fine sands, 1 to 8 percent slopes; 2,500 feet west and 2,400 feet south of the northeast corner of sec. 11, T. 53 N., R. 34 W.

A—0 to 1 inch; very dark gray (5YR 3/1) loamy fine sand, gray (5YR 5/1) dry; weak fine subangular blocky structure; very friable; many roots; strongly acid; abrupt smooth boundary.

E—1 to 6 inches; reddish gray (5YR 5/2) loamy fine sand; weak fine subangular blocky structure; very friable; many roots; about 1 percent gravel; medium acid; abrupt irregular boundary.

Bs1—6 to 8 inches; reddish brown (5YR 4/3) fine sandy loam; weak fine subangular blocky structure; very friable; many roots; about 1 percent gravel; medium acid; abrupt broken boundary.

Bs2—8 to 18 inches; brown (7.5YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable; many roots; about 5 percent gravel; medium acid; clear irregular boundary.

B/E1—18 to 20 inches; about 85 percent yellowish red (5YR 4/6) sandy loam (Bt); common fine pores; few distinct clay films on faces of peds; surrounded by pinkish gray (5YR 6/2) fine sandy loam (E); weak medium subangular blocky structure; very firm; about 5 percent gravel; medium acid; clear wavy boundary.

B/E2—20 to 30 inches; about 60 percent reddish brown (2.5YR 4/4) sandy loam (Bt); common fine pores; common distinct clay films around pebbles; surrounded by pinkish gray (5YR 6/2) loamy sand (E); common medium prominent reddish yellow (5YR 6/8) mottles; moderate thick platy structure; very firm; about 12 percent gravel; medium acid; abrupt smooth boundary.

2R—30 inches; sandstone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of gravel ranges from 0 to 10 percent in the A and E horizons and from 0 to 15 percent in the subsoil. The content of sandstone flagstones and cobbles ranges from 0 to 5 percent.

The A horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an Ap horizon. This horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. The E horizon has hue of 5YR or 7.5YR and chroma of 2 or 3. The A, Ap, and E horizons are loamy sand, loamy fine sand, fine sandy loam, or sandy loam.

The Bs horizon has value of 3 or 4 and chroma of 3 to 6. Some pedons have a Bhs horizon. The B horizon is sandy loam or fine sandy loam. The Bt part of the B/E horizon has hue of 2.5YR or 5YR, value of 3 or 4, and chroma of 4 to 6. It is sandy loam or fine sandy loam. The E part has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is loamy sand, sandy loam, or fine sandy loam. Some pedons have an E/B horizon. Some have a 2Cr horizon. This horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 1 to 6. It generally is mottled channery sandy loam or channery loamy sand.

Alcona Series

The Alcona series consists of very deep, moderately well drained or well drained, moderately permeable soils on lake plains, till plains, and stream terraces. These soils formed in loamy, silty, and sandy deposits. Slopes range from 0 to 70 percent.

Typical pedon of Alcona loamy fine sand, in an area of Liminga-Alcona complex, 0 to 8 percent slopes; 2,100 feet west and 100 feet north of the southeast corner of sec. 11, T. 48 N., R. 36 W.

A—0 to 3 inches; dark reddish brown (5YR 3/2) loamy fine sand, pinkish gray (5YR 6/2) dry; moderate fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

E—3 to 6 inches; pinkish gray (5YR 6/2) loamy fine sand; weak thin platy structure; friable; common roots; strongly acid; abrupt wavy boundary.

Bhs—6 to 7 inches; dark reddish brown (5YR 3/3) loamy fine sand; weak fine subangular blocky structure; friable; common roots; very strongly acid; clear wavy boundary.

Bs1—7 to 11 inches; dark reddish brown (5YR 3/4) loamy fine sand; weak fine subangular blocky structure; friable; common roots; strongly acid; clear wavy boundary.

Bs2—11 to 19 inches; reddish brown (5YR 4/4) loamy fine sand; weak fine subangular blocky structure; friable; few roots; medium acid; clear wavy boundary.

E&Bt—19 to 48 inches; reddish brown (5YR 5/4) loamy fine sand (E); weak thin platy structure parting to

weak fine subangular blocky; friable; lamellae of reddish brown (7.5YR 4/4) fine sandy loam (Bt); weak fine subangular blocky structure; friable; few distinct clay films on faces of peds; few roots; medium acid; gradual wavy boundary.

C—48 to 60 inches; stratified, reddish brown (5YR 5/3) fine sand, loamy fine sand, and fine sandy loam; massive; very friable; neutral.

The thickness of the solum ranges from 22 to 60 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 1 or 2. The E horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. The A and E horizons are very fine sandy loam, fine sandy loam, or loamy fine sand.

The Bhs horizon has hue of 5YR or 7.5YR and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. The Bhs and Bs horizons have textures similar to those of the A and E horizons. The E part of the E&B horizon has colors and textures similar to those of the E horizon. The B part has hue of 7.5YR, 5YR, or 2.5YR, value of 3 to 6, and chroma of 3 or 4. It is fine sandy loam, very fine sandy loam, or loam.

The C horizon has hue of 7.5YR to 2.5YR, value of 4 to 7, and chroma of 3 to 6. It is stratified loamy fine sand, fine sand, fine sandy loam, or very fine sandy loam.

Allendale Series

The Allendale series consists of very deep, somewhat poorly drained soils on lake plains and till plains. These soils formed in sandy glacial material over clayey lacustrine deposits. Permeability is rapid in the upper part of the pedon and very slow in the lower part. Slopes range from 0 to 3 percent.

Typical pedon of Allendale sand, in an area of Allendale-Rudyard complex, 0 to 3 percent slopes; 350 feet south and 60 feet west of the northeast corner of sec. 6, T. 52 N., R. 34 W.

Ap—0 to 7 inches; dark brown (7.5YR 3/2) sand, pinkish gray (7.5YR 7/2) dry; moderate medium granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

E—7 to 12 inches; brown (7.5YR 5/2) sand; common medium faint brown (7.5YR 4/2) and common medium distinct brown (7.5YR 5/4) mottles; moderate medium subangular blocky structure; very friable; many roots; medium acid; clear wavy boundary.

Bs1—12 to 15 inches; dark brown (7.5YR 3/4) sand; common medium distinct brown (7.5YR 4/2), many medium distinct strong brown (7.5YR 4/6), and many medium faint brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure parting to moderate fine subangular blocky; very friable; many roots; medium acid; clear wavy boundary.

Bs2—15 to 23 inches; brown (7.5YR 4/4) sand; common medium distinct brown (7.5YR 4/2) and many medium distinct strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; very friable; common roots; medium acid; clear smooth boundary.

2Bt—23 to 45 inches; reddish brown (2.5YR 4/4) silty clay; common medium prominent strong brown (7.5YR 4/6) and common medium prominent dark brown (7.5YR 4/4) mottles; weak coarse angular blocky structure; firm; few roots; ped coatings and crack fillings of brown (7.5YR 4/2) sand in the upper several inches; neutral; clear smooth boundary.

2C—45 to 60 inches; reddish brown (2.5YR 4/4) silty clay; massive; firm; mildy alkaline; weak effervescence.

The thickness of the sandy material ranges from 20 to 40 inches. The Ap horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. Pedons in forested areas have an A horizon. The E horizon has hue of 7.5YR or 10YR and value of 5 or 6. The A and E horizons are dominantly sand, but the range includes loamy sand. The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. It is sand or loamy sand. The 2Bt horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 2 to 4. The 2C horizon is clay or silty clay.

Allouez Series

The Allouez series consists of very deep, well drained soils on stream terraces, in glacial drainageways, and on old beach ridges. These soils formed in gravelly, loamy, and sandy glacial drift. Permeability is moderately rapid in the upper part of the pedon and very rapid in the lower part. Slopes range from 0 to 15 percent.

Typical pedon of Allouez gravelly silt loam, 0 to 8 percent slopes, 1,218 feet west and 1,421 feet south of the northeast corner of sec. 5, T. 56 N., R. 32 W.

A—0 to 7 inches; dark reddish brown (5YR 3/2) gravelly silt loam, dark reddish gray (5YR 4/2) dry; moderate fine granular structure; very friable; many fine roots; about 20 percent gravel and 10 percent cobbles; medium acid; abrupt smooth boundary.

Bw1—7 to 12 inches; dark reddish brown (5YR 3/3) very gravelly fine sandy loam; weak fine granular structure; very friable; common fine roots; about 30 percent gravel and 10 percent cobbles; medium acid; clear smooth boundary.

2Bw2—12 to 18 inches; dark reddish brown (5YR 3/4) extremely gravelly coarse sand; single grained; loose; few fine roots; about 55 percent gravel and 10 percent cobbles; medium acid; clear smooth boundary.

2C—18 to 60 inches; dark brown (7.5YR 4/4) extremely gravelly coarse sand; single grained; loose; about 70 percent gravel and 10 percent cobbles; medium acid.

The thickness of the solum ranges from 18 to 40 inches. The thickness of the loamy-skeletal material ranges from 10 to 24 inches. The content of gravel ranges from 15 to 60 percent in the A and Bw horizons and from 35 to 70 percent in the 2Bw and 2C horizons. The content of cobbles ranges from 10 to 15 percent in the A and Bw horizons and from 10 to 35 percent in the 2Bw and 2C horizons.

The A horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. The Bw horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. It is very gravelly fine sandy loam, very gravelly sandy loam, very gravelly coarse sandy loam, gravelly sandy loam, or gravelly loam. The 2Bw horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. It is extremely gravelly coarse sand, extremely gravelly sand, very gravelly coarse sand, or very gravelly sand. The 2C horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 to 4. It is extremely gravelly coarse sand or extremely gravelly sand.

Alstad Series

The Alstad series consists of very deep, somewhat poorly drained, moderately slowly permeable soils on till plains. These soils formed in loamy glacial till. Slopes range from 0 to 3 percent.

Typical pedon of Alstad loam, in an area of Watton-Alstad complex, 0 to 6 percent slopes; 2,075 feet north and 250 feet west of the southeast corner of sec. 35, T. 48 N., R. 36 W.

A—0 to 5 inches; dark reddish brown (5YR 3/3) loam, reddish gray (5YR 5/2) dry; moderate fine granular structure; friable; many roots; about 6 percent gravel and 4 percent cobbles; medium acid; abrupt smooth boundary.

E—5 to 7 inches; reddish brown (5YR 5/3) loam; few fine distinct reddish yellow (5YR 6/6) mottles; weak fine subangular blocky structure; friable; many roots; about 6 percent gravel and 4 percent cobbles; medium acid; clear wavy boundary.

B/E—7 to 13 inches; about 70 percent reddish brown (5YR 4/4) clay loam (Bt); common fine distinct yellowish red (5YR 5/6) and common fine distinct reddish gray (5YR 5/2) mottles; tongues of reddish brown (5YR 5/3) loam (E); weak medium subangular blocky structure; firm; few distinct clay films on faces of peds; common roots; about 5 percent gravel and 2 percent cobbles; medium acid; clear wavy boundary.

Bt1—13 to 21 inches; reddish brown (5YR 4/4) clay loam; few fine distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few roots; common clay films on faces of peds; about 5 percent gravel and 2 percent cobbles; slightly acid; gradual wavy boundary.

Bt2—21 to 29 inches; reddish brown (5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few roots; few clay films on faces of peds; about 5 percent gravel and 2 percent cobbles; slightly acid; clear wavy boundary.

C—29 to 60 inches; reddish brown (5YR 4/4) loam; massive; friable; about 5 percent gravel and 2 percent cobbles; neutral.

The thickness of the solum ranges from 20 to 50 inches. The content of gravel ranges from 1 to 10 percent. The content of cobbles ranges from 0 to 5 percent.

The A horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. Pedons in cultivated areas have an Ap horizon. This horizon has hue of 5YR, value of 3 or 4, and chroma of 2 or 3. The E horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam, silt loam, or fine sandy loam.

The B/E horizon has the same colors and textures as the Bt and E horizons. The Bt horizon has chroma of 3 or 4. It is clay loam or silty clay loam.

The C horizon has chroma of 2 to 4. It is loam, clay loam, or silty clay loam.

Arcadian Series

The Arcadian series consists of shallow, well drained, moderately permeable soils on rocky knolls, ridges, till

plains, and postglacial lake shorelines. These soils formed in gravelly or cobbly, loamy material over igneous or metamorphic bedrock. Slopes range from 1 to 35 percent.

Typical pedon of Arcadian very cobbly fine sandy loam, in an area of Arcadian-Michigamme-Rock outcrop complex, 1 to 8 percent slopes; 700 feet east and 1,250 feet north of the southwest corner of sec. 1, T. 54 N., R. 34 W.

A—0 to 5 inches; dark brown (7.5YR 3/2) very cobbly fine sandy loam, brown (7.5YR 4/2) dry; weak fine granular structure; very friable; many roots; about 20 percent gravel and 25 percent cobbles; slightly acid; clear smooth boundary.
Bw1—5 to 13 inches; dark reddish brown (5YR 3/3) very cobbly fine sandy loam, dark reddish gray (5YR 4/2) dry; weak fine granular structure; very friable; many roots; about 30 percent gravel and 25 percent cobbles; slightly acid; clear wavy boundary.
Bw2—13 to 18 inches; dark reddish brown (5YR 3/4) very cobbly fine sandy loam; weak fine subangular blocky structure; very friable; many roots; about 30 percent gravel and 25 percent cobbles; slightly acid; abrupt wavy boundary.
R—18 inches; basalt bedrock.

The content of gravel ranges from 20 to 65 percent, and the content of cobbles ranges from 5 to 40 percent. The soils are the very gravelly, very cobbly, extremely gravelly, or extremely cobbly analogs of very fine sandy loam, fine sandy loam, silt loam, or sandy loam.

The A horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The Bw horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4.

Arnheim Series

The Arnheim series consists of very deep, poorly drained, moderately permeable soils on flood plains. These soils formed in stratified, loamy and silty alluvium. Slopes are 0 to 1 percent.

Typical pedon of Arnheim silt loam, in an area of Sturgeon-Arnheim-Pelkie association; 400 feet north and 650 feet east of the southwest corner of sec. 9, T. 53 N., R. 33 W.

A—0 to 4 inches; reddish brown (5YR 4/3) silt loam, pinkish gray (5YR 6/2) dry; moderate fine granular structure; friable; many roots; strongly acid; clear smooth boundary.
C1—4 to 18 inches; dark reddish gray (5YR 4/2) silt loam; many fine distinct yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; friable; common roots; strongly acid; clear smooth boundary.
C2—18 to 30 inches; reddish brown (5YR 5/3) silt loam; many fine distinct yellowish red (5YR 4/6) mottles; massive; friable; few roots; medium acid; abrupt smooth boundary.
C3—30 to 52 inches; brown (7.5YR 4/4), stratified loamy fine sand and fine sand; few fine distinct yellowish red (5YR 4/4) mottles; massive; friable; medium acid; clear wavy boundary.
C4—52 to 60 inches; dark brown (7.5YR 4/2) very fine sandy loam; few distinct black (N 2/0) bands of organic material; massive; friable; neutral.

The A horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 to 4. The C horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 to 6. It is dominantly silt loam, very fine sandy loam, or loamy very fine sand. In some pedons, however, thin layers of fine sand, loamy fine sand, or fine sandy loam are within a depth of 40 inches or strata of silty clay loam or sand are below a depth of 40 inches.

Assinins Series

The Assinins series consists of very deep, somewhat poorly drained soils on till plains and moraines. These soils formed in sandy and loamy glacial till. Permeability is rapid in the sandy material and moderate or moderately slow in the loamy material. Slopes range from 0 to 3 percent.

The Assinins soils in this survey area have a thicker layer of sandy material than is definitive for the series. This difference, however, does not alter the use or management of the soils.

Typical pedon of Assinins sand, in an area of Assinins-Skanee complex, 0 to 3 percent slopes; 2,400 feet north and 1,100 feet west of the southeast corner of sec. 9, T. 54 N., R. 31 W.

Oa—3 inches to 0; black (N 2/0), well decomposed leaf litter; very strongly acid; abrupt smooth boundary.
A—0 to 1 inch; very dark gray (5YR 3/1) sand, reddish gray (5YR 5/2) dry; moderate fine subangular blocky structure; very friable; many roots; about 5 percent gravel; very strongly acid; abrupt smooth boundary.
E—1 to 14 inches; pinkish gray (5YR 6/2) sand; weak fine subangular blocky structure; very friable; many roots; about 5 percent gravel; very strongly acid; abrupt wavy boundary.
Bs1—14 to 20 inches; dark reddish brown (5YR 3/4)

sand; common medium distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; very friable; common roots; about 5 percent gravel; very strongly acid; clear wavy boundary.

Bs2—20 to 26 inches; reddish brown (5YR 4/4) sand; common medium distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; very friable; few roots; about 2 percent gravel; very strongly acid; clear wavy boundary.

Bs3—26 to 33 inches; brown (7.5YR 4/4) sand; common medium prominent yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; very friable; few roots; about 3 percent gravel; strongly acid; abrupt wavy boundary.

2B/E—33 to 45 inches; about 60 percent reddish brown (2.5YR 4/4) sandy loam (Bt); common pores; thin clay films in pores; surrounded by reddish brown (5YR 4/3) loamy sand (E); few medium prominent yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; firm; about 8 percent gravel; strongly acid; clear wavy boundary.

2C—45 to 60 inches; reddish brown (2.5YR 4/4) fine sandy loam; massive; friable; about 5 percent gravel; strongly acid.

The thickness of the sandy material ranges from 20 to 40 inches. The thickness of the solum ranges from 26 to 55 inches. The solum has 1 to 10 percent gravel.

The E horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. The A and E horizons are dominantly sand, but the range includes loamy sand and fine sand.

The B horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. It is sand, loamy sand, or fine sand. The E part of the 2B/E horizon has value of 4 or 5 and chroma of 2 or 3. It is sand, loamy sand, or sandy loam. The Bt part has hue of 2.5YR or 5YR. It is sandy loam or fine sandy loam.

The 2C horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It is sandy loam or fine sandy loam.

Au Gres Series

The Au Gres series consists of very deep, somewhat poorly drained, rapidly permeable soils on outwash plains, lake plains, and till plains. These soils formed in sandy material. Slopes range from 0 to 3 percent.

Typical pedon of Au Gres sand, 0 to 3 percent slopes, 1,858 feet east and 493 feet south of the northwest corner of sec. 17, T. 55 N., R. 31 W.

Oa—1 inch to 0; black (7.5YR 2/0), well decomposed forest litter; many roots; abrupt smooth boundary.

E—0 to 19 inches; light brownish gray (10YR 6/2) sand; common medium faint brown (10YR 5/3) mottles; weak fine subangular blocky structure parting to weak fine granular; many roots; very strongly acid; abrupt wavy boundary.

Bhs—19 to 27 inches; dark reddish brown (5YR 3/2) sand; single grained; loose; few roots; about 20 percent weak ortstein; strongly acid; clear wavy boundary.

Bs—27 to 32 inches; reddish brown (5YR 4/4) sand; single grained; loose; strongly acid; clear wavy boundary.

BC—32 to 39 inches; yellowish red (5YR 5/6) sand; single grained; loose; strongly acid; gradual wavy boundary.

C—39 to 60 inches; brown (7.5YR 5/4) sand; single grained; loose; medium acid.

The thickness of the solum ranges from 24 to more than 48 inches. The A horizon, if it occurs, has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 or 2. The E horizon has hue of 5YR to 10YR, value of 5 to 7, and chroma of 1 or 2. The Bhs horizon has value and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 4 to 6. The C horizon has hue of 5YR or 7.5YR and value and chroma of 4 to 6.

Bergland Series

The Bergland series consists of very deep, poorly drained, very slowly permeable soils on lake plains. These soils formed in silty and clayey lacustrine deposits. Slopes range from 0 to 2 percent.

Typical pedon of Bergland muck, 2,000 feet north and 800 feet east of the southwest corner of sec. 9, T. 52 N., R. 34 W.

Oa—0 to 5 inches; black (N 2/0) muck; moderate fine granular structure; friable; many roots; medium acid; abrupt wavy boundary.

A—5 to 9 inches; very dark gray (10YR 3/1) silty clay, dark greenish gray (5G 4/1) dry; common medium prominent yellowish red (5YR 5/6) mottles; moderate medium granular structure; friable; many roots; slightly acid; abrupt wavy boundary.

Bg—9 to 13 inches; dark reddish gray (5YR 4/2) clay; common fine prominent yellowish red (5YR 5/8) mottles; weak coarse subangular blocky structure; firm; few roots; common fine distinct dark reddish brown (5YR 3/2) organic stains and coatings; slightly acid; abrupt wavy boundary.

Bw—13 to 20 inches; reddish brown (2.5YR 5/4) clay; weak coarse subangular blocky structure; firm; few roots; few fine prominent white (5YR 8/1) threadlike veins and coatings; neutral; gradual wavy boundary.

C1—20 to 45 inches; reddish brown (2.5YR 4/4) clay; weak coarse subangular blocky structure; firm; many medium prominent white (5YR 8/1) threadlike veins and coatings; mildly alkaline; gradual wavy boundary.

C2—45 to 60 inches; reddish brown (2.5YR 4/4) silty clay; massive; firm; many prominent white (5YR 8/1) coatings between varves; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 15 to 30 inches. The A horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1, or it is neutral in hue and has value of 2 or 3. The Bg horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 1 or 2. It is clay or silty clay. The Bw horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. The faces of peds and root channels in this horizon commonly have chroma of 1. The C horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It is clay or silty clay.

Cathro Series

The Cathro series consists of very deep, very poorly drained soils in depressions on till plains, lake plains, and moraines. These soils formed in herbaceous organic deposits underlain by loamy and silty material. Permeability is moderately slow to moderately rapid in the organic material and moderate or moderately slow in the underlying material. Slopes are 0 to 1 percent.

Typical pedon of Cathro muck, in an area of Lupton and Cathro mucks; 800 feet east and 1,200 feet north of the southwest corner of sec. 34, T. 56 N., R. 33 W.

Oa1—0 to 9 inches; muck, black (5YR 2/1) broken face and rubbed; about 30 percent fiber, 10 percent rubbed; moderate medium granular structure; nonsticky; many roots; mainly herbaceous fibers; slightly acid; abrupt smooth boundary.

Oa2—9 to 20 inches; muck, black (5YR 2/1) broken face and rubbed; about 20 percent fiber, 5 percent rubbed; moderate fine granular structure; nonsticky; few roots; herbaceous and woody fibers; slightly acid; abrupt smooth boundary.

Oa3—20 to 46 inches; muck, very dark grayish brown (10YR 3/2) broken face, black (10YR 2/1) rubbed; about 50 percent fiber, 10 percent rubbed; massive; nonsticky; herbaceous fibers; slightly acid; abrupt smooth boundary.

C—46 to 60 inches; dark grayish brown (10YR 4/2) fine sandy loam; massive; friable; slightly acid.

Depth to the C horizon ranges from 16 to 50 inches. The organic material is primarily of herbaceous origin, but as much as 50 percent of the fibers are woody in some pedons. The organic material has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. It is dominantly muck, but some pedons have thin layers of mucky peat or peat. The C horizon has hue of 5YR to 5GB, value of 4 to 6, and chroma of 1 to 3. It is sandy loam, fine sandy loam, or silt loam.

Champion Series

The Champion series consists of very deep, moderately well drained or well drained soils on till plains and moraines. These soils formed in silty material and in the underlying loamy or sandy glacial till. They have a fragipan. Permeability is moderate in the upper part of the pedon, very slow in the fragipan, and moderate or moderately rapid in the lower part of the pedon. Slopes range from 0 to 35 percent.

Typical pedon of Champion cobbly very fine sandy loam, 1 to 8 percent slopes, 2,450 feet south and 1,790 feet west of the northeast corner of sec. 21, T. 47 N., R. 36 W.

Oe—1 inch to 0; black (5YR 2/1), partially decomposed forest litter; many roots; abrupt smooth boundary.

E—0 to 4 inches; reddish gray (5YR 5/2) cobbly very fine sandy loam; weak thin platy structure; friable; many roots; about 6 percent gravel and 10 percent cobbles; very strongly acid; abrupt wavy boundary.

Bhs—4 to 9 inches; dark reddish brown (5YR 3/3) cobbly very fine sandy loam; weak fine subangular blocky structure; friable; common roots; about 6 percent gravel and 10 percent cobbles; very strongly acid; clear wavy boundary.

Bs—9 to 18 inches; dark reddish brown (5YR 3/4) cobbly fine sandy loam; weak fine subangular blocky structure; friable; common roots; about 6 percent gravel and 10 percent cobbles; strongly acid; abrupt wavy boundary.

2Bx—18 to 27 inches; reddish brown (5YR 4/4) gravelly fine sandy loam; common medium distinct yellowish red (5YR 5/8) mottles; weak thin platy structure parting to weak fine subangular blocky; very firm; few roots; about 16 percent gravel and 8 percent

cobbles; strongly acid; gradual wavy boundary.

2E/Bx—27 to 49 inches; about 60 percent brown (7.5YR 4/2) gravelly loamy fine sand (E); common medium distinct yellowish red (5YR 5/8) mottles; surrounding peds of reddish brown (5YR 4/4) gravelly loamy fine sand (B); weak thin platy structure parting to weak fine subangular blocky; very firm; about 18 percent gravel and 15 percent cobbles; medium acid; clear wavy boundary.

2C—49 to 60 inches; brown (7.5YR 5/4) gravelly loamy sand; massive; friable; about 18 percent gravel and 7 percent cobbles; medium acid.

The thickness of the loamy mantle ranges from 16 to 24 inches. The thickness of the solum ranges from 30 to 70 inches. Depth to the fragipan ranges from 14 to 24 inches. The content of gravel ranges from 0 to 10 percent in the A, E, and B horizons and from 15 to 35 percent in the 2B, 2E/Bx, and 2C horizons. The content of cobbles and stones ranges from 0 to 35 percent in the A, E, and B horizons and from 0 to 15 percent in the 2B, 2E/Bx, and 2C horizons.

The O horizon has hue of 5YR or 7.5YR and chroma of 1, or it is neutral in hue and has value of 2. The A horizon, if it occurs, has hue of 5YR to 10YR, value of 2 to 4, and chroma of 1 or 2. The E horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2.

The Bhs horizon has hue of 2.5YR or 5YR and chroma of 2 or 3. The Bs horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 3 or 4. The B horizon is silt loam, very fine sandy loam, fine sandy loam, or the cobbly analogs of those textures.

The 2Bx and 2E/Bx horizons have hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4. The 2C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 4. The 2Bx and 2C horizons are dominantly gravelly fine sandy loam, gravelly sandy loam, gravelly loamy sand, or gravelly loamy fine sand, but pockets and lenses of gravelly sand are in some pedons.

Croswell Series

The Croswell series consists of very deep, moderately well drained, rapidly permeable soils on outwash plains, sandy lake plains, and beaches. These soils formed in sandy material. Slopes range from 0 to 3 percent.

Typical pedon of Croswell sand, 0 to 3 percent slopes, 2,500 feet east and 1,700 feet north of the southwest corner of sec. 17, T. 55 N., R. 31 W.

A—0 to 1 inch; very dark gray (N 3/0) sand, gray (N 5/0) dry; weak fine granular structure; loose; many roots; strongly acid; clear smooth boundary.

E1—1 to 7 inches; light gray (5YR 7/1) sand; single grained; loose; many roots; very strongly acid; clear wavy boundary.

E2—7 to 16 inches; pinkish gray (5YR 6/2) sand; single grained; loose; common roots; strongly acid; abrupt wavy boundary.

Bs—16 to 22 inches; brown (7.5YR 4/4) sand; weak fine subangular blocky structure; loose; common roots; medium acid; gradual wavy boundary.

BC—22 to 31 inches; reddish yellow (7.5YR 6/6) sand; common medium distinct reddish yellow (7.5YR 6/8) mottles; single grained; loose; few roots; medium acid; gradual wavy boundary.

C—31 to 60 inches; reddish yellow (7.5YR 7/6) sand; common medium distinct reddish yellow (7.5YR 6/8) mottles; single grained; loose; few roots; medium acid.

The thickness of the solum ranges from 20 to 45 inches. The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. The E horizon has hue of 5YR to 10YR, value of 5 to 7, and chroma of 1 or 2. The Bs horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 3 to 6. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 3 to 7.

Dawson Series

The Dawson series consists of very deep, very poorly drained soils in depressions on moraines, outwash plains, and lake plains. These soils formed in herbaceous organic deposits underlain by sandy material. Permeability is moderately slow to moderately rapid in the organic material and rapid in the underlying sand. Slopes are 0 to 1 percent.

Typical pedon of Dawson peat, in an area of Dawson and Loxley peats; 1,100 feet south and 100 feet west of the northeast corner of sec. 20, T. 55 N., R. 31 W.

Oi—0 to 6 inches; peat, dark brown (10YR 3/3) broken face and dark brown (10YR 4/3) rubbed; about 90 percent fiber, 80 percent rubbed; massive; nonsticky; primarily sphagnum moss fibers; extremely acid; abrupt smooth boundary.

Oe—6 to 10 inches; mucky peat, black (10YR 2/1) broken face and rubbed; about 80 percent fiber, 30 percent rubbed; massive; nonsticky; primarily herbaceous fibers; extremely acid; abrupt smooth boundary.

Oa1—10 to 18 inches; muck, very dark brown (10YR

2/2) broken face and rubbed; about 15 percent fiber, 5 percent rubbed; massive; nonsticky; primarily herbaceous fibers; extremely acid; clear wavy boundary.

Oa2—18 to 30 inches; muck, black (10YR 2/1) broken face and rubbed; about 15 percent fiber, 5 percent rubbed; massive; nonsticky; primarily herbaceous fibers; extremely acid; abrupt smooth boundary.

A—30 to 34 inches; very dark grayish brown (10YR 3/2) sand; massive; nonsticky; very strongly acid; clear wavy boundary.

C—34 to 60 inches; brown (10YR 4/3) sand; single grained; nonsticky; very strongly acid.

The thickness of the organic material ranges from 16 to 50 inches. The surface tier has hue of 5YR to 10YR, value of 2 to 6, and chroma of 1 to 4. The subsurface and bottom tiers have hue of 5YR to 10YR, value of 2 to 4, and chroma of 1 to 3. The C horizon has hue of 10YR to 2.5Y, value of 3 to 6, and chroma of 1 to 6. It is sand, fine sand, loamy fine sand, gravelly sand, or loamy sand.

Deer Park Series

The Deer Park series consists of very deep, excessively drained, rapidly permeable soils on beach ridges and dunes. These soils formed in sandy material. Slopes range from 0 to 15 percent.

Typical pedon of Deer Park sand, 0 to 8 percent slopes, 660 feet north and 245 feet west of the southeast corner of sec. 21, T. 56 N., R. 34 W.

Oe—2 inches to 0; black (10YR 2/1), partially decomposed leaf litter.

A—0 to 4 inches; black (10YR 2/1) sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; common roots; very strongly acid; abrupt smooth boundary.

E—4 to 24 inches; pale brown (10YR 6/3) sand; single grained; loose; common roots; medium acid; clear smooth boundary.

Bs1—24 to 27 inches; yellowish brown (10YR 5/4) sand; single grained; loose; few roots; medium acid; gradual wavy boundary.

Bs2—27 to 36 inches; brown (10YR 5/3) sand; single grained; loose; few roots; medium acid; gradual smooth boundary.

C—36 to 60 inches; pale brown (10YR 6/3) sand; single grained; loose; slightly acid.

The thickness of the solum ranges from 18 to 50 inches. The soils are sand or fine sand throughout.

Some pedons do not have an A horizon. The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. The Bs horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 6. The C horizon has hue of 7.5YR or 10YR, value of 6 or 7, and chroma of 3 or 4.

Deerton Series

The Deerton series consists of moderately deep, somewhat excessively drained, rapidly permeable or moderately rapidly permeable soils on bedrock benches and till plains. These soils formed in 20 to 40 inches of sandy material over sandstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Deerton sand, 1 to 8 percent slopes, 20 feet east and 10 feet north of the southwest corner of sec. 2, T. 55 N., R. 33 W.

Oe—1 inch to 0; black (5YR 2/1), partially decomposed forest litter; many roots; very strongly acid; abrupt smooth boundary.

E—0 to 8 inches; reddish brown (5YR 5/3) sand; weak fine subangular blocky structure; very friable; common roots; about 5 percent gravel; strongly acid; clear wavy boundary.

Bhs—8 to 10 inches; dark reddish brown (5YR 3/3) sand; moderate medium subangular blocky structure; friable; common roots; about 5 percent gravel; strongly acid; clear irregular boundary.

Bs1—10 to 16 inches; dark brown (7.5YR 3/4) sand; weak fine and medium subangular blocky structure; very friable; common roots; about 5 percent gravel; medium acid; clear wavy boundary.

Bs2—16 to 27 inches; brown (7.5YR 4/4) sand; weak fine and medium subangular blocky structure; very friable; few roots; about 10 percent sandstone channers; medium acid; clear smooth boundary.

2Cr—27 to 31 inches; reddish brown (2.5YR 4/4), highly weathered and fractured sandstone; few roots; medium acid; clear smooth boundary.

2R—31 inches; reddish brown (2.5YR 4/4) sandstone bedrock.

The thickness of the solum and the depth to bedrock are typically 20 to 30 inches and range from 20 to 40 inches. The solum has 0 to 10 percent gravel and 0 to 20 percent cobbles. Some pedons have an A horizon. This horizon has hue of 5YR or 7.5YR, or it is neutral in hue and has value of 2 or 3 and chroma of 0 or 1. The E horizon has hue of 5YR or 7.5YR and value of 5 or 6. The Bhs horizon has value and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5,

and chroma of 4 to 6. The B horizon is sand or loamy sand.

Fence Series

The Fence series consists of very deep, moderately well drained or well drained, moderately slowly permeable soils on lake plains. These soils formed in stratified, medium-textured, water-laid deposits. Slopes range from 1 to 50 percent.

Typical pedon of Fence very fine sandy loam, in an area of Nunica-Fence complex, dissected, 8 to 35 percent slopes; 100 feet south and 300 feet west of the northeast corner of sec. 7, T. 47 N., R. 36 W.

Oe—2 inches to 0; black (N 2/0), partially decomposed forest litter; many roots; very strongly acid; abrupt smooth boundary.

E—0 to 2 inches; reddish brown (5YR 5/3) very fine sandy loam; weak medium platy structure parting to weak very fine subangular blocky; friable; many roots; strongly acid; clear wavy boundary.

Bs1—2 to 7 inches; reddish brown (5YR 4/4) very fine sandy loam; weak medium platy structure parting to weak very fine subangular blocky; friable; many roots; strongly acid; clear wavy boundary.

Bs2—7 to 13 inches; brown (7.5YR 4/4) very fine sandy loam; weak medium platy structure parting to weak very fine subangular blocky; friable; common roots; strongly acid; gradual wavy boundary.

E/B—13 to 29 inches; about 60 percent reddish brown (5YR 5/3) very fine sandy loam (E); common fine prominent yellowish red (5YR 5/8) mottles; extending into or completely surrounding isolated remnants of reddish brown (2.5YR 4/4) very fine sandy loam (Bt); weak thin platy structure parting to weak very fine subangular blocky; friable; few roots; common thin clay films; thin layers of loamy very fine sand; medium acid; clear wavy boundary.

B/E—29 to 42 inches; about 70 percent reddish brown (2.5YR 4/4) very fine sandy loam (Bt); weak thin platy structure parting to weak medium subangular blocky; friable; common thin clay films; completely surrounded by or penetrated by tongues of reddish brown (5YR 5/3) very fine sandy loam (E); common fine prominent yellowish red (5YR 5/8) mottles; few roots; medium acid; clear wavy boundary.

C—42 to 60 inches; reddish brown (5YR 4/3), stratified silt loam and very fine sandy loam; massive; friable; slightly acid.

The thickness of the solum ranges from 30 to 60 inches. The A horizon, if it occurs, has hue of 5YR or 7.5YR, value of 2 to 4, and chroma of 2 or 3. The E horizon has value of 5 or 6 and chroma of 2 or 3. The Bs1 horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. The Bs2 horizon has chroma of 4 to 6. The Bs horizon is very fine sandy loam, loamy very fine sand, or fine sandy loam. The E part of the E/B and B/E horizons has value of 5 or 6 and chroma of 2 to 4. The Bt part has hue of 2.5YR or 5YR. The E/B and B/E horizons are very fine sandy loam, silt loam, or silt.

The C horizon has hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 3 to 6. It is dominantly stratified silt loam, very fine sandy loam, loamy very fine sand, or very fine sand but has occasional strata of silty clay loam, fine sand, or sand.

Freda Series

The Freda series consists of shallow, well drained, moderately permeable soils on till plains and glacial lake benches. These soils formed in silty and loamy deposits over shale and siltstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Freda silt loam, 1 to 8 percent slopes, 2,600 feet west and 1,200 feet north of the southeast corner of sec. 4, T. 54 N., R. 36 W.

Oe—1 inch to 0; black (5YR 2/1), partially decomposed forest litter; many roots; abrupt wavy boundary.

A—0 to 1 inch; black (5YR 2/1) silt loam, gray (5YR 4/1) dry; moderate fine granular structure; friable; many roots; about 5 percent shale channers; extremely acid; abrupt wavy boundary.

E—1 to 4 inches; dark reddish gray (5YR 4/2) silt loam; moderate medium subangular blocky structure; friable; few roots; about 5 percent shale channers; extremely acid; abrupt wavy boundary.

Bhs—4 to 8 inches; dark reddish brown (5YR 3/3) silt loam; weak medium subangular blocky structure; friable; few roots; about 5 percent shale channers; very strongly acid; clear wavy boundary.

Bs—8 to 12 inches; dark reddish brown (5YR 3/4) channery silt loam; moderate medium subangular blocky structure; friable; few roots; about 15 percent shale channers; very strongly acid; clear wavy boundary.

2Cr—12 to 16 inches; reddish brown (5YR 4/4), highly weathered shale; very strongly acid; clear smooth boundary.

3R—16 inches; shale bedrock.

The content of shale channers ranges from 0 to 15

percent in the A, E, and Bhs horizons and from 10 to 35 percent in the Bs horizon. The A horizon has value of 2 to 4 and chroma of 1 or 2. The E horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. The E horizon is silt loam, very fine sandy loam, or loam. The Bhs horizon has hue of 5YR or 2.5YR and value and chroma of 2 or 3. It is silt loam, very fine sandy loam, or loam. The Bs horizon has hue of 2.5YR or 5YR and value of 3 or 4. It is silt loam, very fine sandy loam, loam, fine sandy loam, or the channery analogs of those textures.

Some pedons have a C horizon. This horizon has hue of 5YR or 2.5YR, value of 4 to 6, and chroma of 3 or 4. It is sandy loam, fine sandy loam, or the channery analogs of those textures. The 2Cr horizon has hue of 2.5YR or 5YR and value and chroma of 3 or 4. The underlying bedrock is shale or siltstone.

Froberg Series

The Froberg series consists of very deep, moderately well drained soils on lake plains. These soils formed in clayey lacustrine deposits underlain by loamy glacial till. Permeability is very slow in the upper part of the pedon and moderate or moderately slow in the lower part. Slopes range from 1 to 8 percent.

Typical pedon of Froberg silt loam, in an area of Froberg-Rudyard silt loams, 1 to 8 percent slopes; 2,600 feet west and 1,950 feet south of the northeast corner of sec. 5, T. 52 N., R. 34 W.

Ap—0 to 6 inches; reddish brown (5YR 4/3) silt loam, reddish gray (5YR 5/2) dry; weak fine subangular blocky structure; friable; many roots; medium acid; clear smooth boundary.

B/E—6 to 12 inches; about 90 percent reddish brown (2.5YR 4/4) silty clay (Bt); surrounded by reddish brown (5YR 5/3) silty clay loam (E); weak fine and medium subangular blocky structure; firm; common roots; medium acid; clear wavy boundary.

Bt1—12 to 24 inches; reddish brown (2.5YR 4/4) silty clay; strong medium angular blocky structure; very firm; common clay films on faces of peds; common roots; medium acid; clear wavy boundary.

Bt2—24 to 32 inches; reddish brown (2.5YR 4/4) silty clay; common medium prominent light reddish brown (5YR 6/4) mottles and streaks of fine sandy loam; moderate medium subangular blocky structure; very firm; common clay films on faces of peds; few roots; slightly acid; gradual wavy boundary.

2C—32 to 60 inches; reddish brown (2.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; slightly acid.

The thickness of the lacustrine sediments ranges from 15 to 36 inches. The Ap horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The Bt horizon is clay or silty clay. The 2C horizon has hue of 10R or 2.5YR and value of 4 or 5. It is sandy loam, fine sandy loam, or sandy clay loam and has 0 to 3 percent gravel and 0 to 2 percent cobbles.

Gay Series

The Gay series consists of very deep, poorly drained, moderately permeable soils on till plains. These soils formed in loamy glacial till. Slopes are 0 to 2 percent.

Typical pedon of Gay muck, in an area of Skanee-Gay complex, 0 to 3 percent slopes; 3,400 feet north and 2,000 feet east of the southwest corner of sec. 29, T. 56 N., R. 34 W.

Oa—0 to 5 inches; black (N 2/0) muck; weak fine granular structure; very friable; many roots; slightly acid; clear smooth boundary.

A—5 to 8 inches; black (5YR 2/1) mucky sandy loam, very dark gray (5YR 3/1) dry; weak fine granular structure; very friable; many roots; about 2 percent gravel; slightly acid; clear smooth boundary.

Bw—8 to 16 inches; reddish brown (5YR 4/3) sandy loam; many medium distinct dark gray (5YR 4/1) and many fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; about 5 percent gravel; slightly acid; clear wavy boundary.

BC—16 to 24 inches; reddish brown (5YR 4/3) sandy loam; common medium faint dark reddish gray (5YR 4/2) and common fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; very friable; few roots; about 5 percent gravel; slightly acid; clear smooth boundary.

C—24 to 60 inches; reddish brown (2.5YR 4/4) sandy loam; massive; friable; about 5 percent gravel; slightly acid.

The thickness of the solum ranges from 15 to 30 inches. The soil has 0 to 10 percent gravel and 0 to 2 percent cobbles. The O horizon has hue of 5YR to 10YR, or it is neutral in hue. The A horizon has hue of 5YR to 10YR, value of 2 to 4, and chroma of 1 or 2. The Bw horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 or 4. It is sandy loam or sandy clay loam. The C horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 2 to 4.

Graveraet Series

The Graveraet series consists of very deep, moderately well drained or well drained soils on till plains and end moraines. These soils formed in loamy glacial till. They have a fragipan. Permeability is moderate in the upper part of the profile, very slow in the fragipan, and moderate or moderately slow in the underlying material. Slopes range from 1 to 70 percent.

Typical pedon of Graveraet loam, 1 to 8 percent slopes, 550 feet north and 1,500 feet west of the southeast corner of sec. 20, T. 53 N., R. 36 W.

A—0 to 2 inches; black (5YR 2/1) loam, dark gray (5YR 4/1) dry; moderate fine granular structure; friable; many coarse to fine roots; about 3 percent gravel and 2 percent cobbles; medium acid; abrupt smooth boundary.

Bhs—2 to 8 inches; dark reddish brown (5YR 3/2) loam; moderate fine subangular blocky structure; friable; many roots; about 3 percent gravel and 2 percent cobbles; medium acid; abrupt wavy boundary.

Bs1—8 to 16 inches; dark reddish brown (5YR 3/4) loam; moderate fine subangular blocky structure; friable; common roots; about 3 percent gravel and 2 percent cobbles; medium acid; clear wavy boundary.

Bs2—16 to 21 inches; reddish brown (5YR 4/4) loam; few medium distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; friable; common roots; about 3 percent gravel; medium acid; abrupt wavy boundary.

E/Bx—21 to 32 inches; about 60 percent light reddish brown (5YR 6/4) fine sandy loam (E); few medium prominent yellowish red (5YR 5/6) mottles; surrounding peds of reddish brown (2.5YR 4/4) loam (Bt); weak thin platy structure; very firm; few roots; common fine vesicular pores; common distinct reddish brown (5YR 4/4) clay films in pores and on faces of peds; about 3 percent gravel; medium acid; clear wavy boundary.

B/Ex—32 to 39 inches; about 60 percent reddish brown (2.5YR 4/4) loam (Bt); common fine vesicular pores; common distinct reddish brown (5YR 4/4) clay films in pores and on faces of peds; surrounded by light reddish brown (5YR 6/4) fine sandy loam (E); few medium distinct yellowish red (5YR 5/6) mottles; weak thin platy structure; very firm; few roots; about 3 percent gravel; slightly acid; clear wavy boundary.

C—39 to 60 inches; reddish brown (5YR 4/3) loam; weak fine subangular blocky structure; friable; about 3 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 60 inches. Depth to the fragipan ranges from 12 to 24 inches. The soil has 0 to 15 percent gravel and 0 to 10 percent cobbles.

The A horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. The E horizon, if it occurs, has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2. The Bhs horizon has hue of 5YR or 7.5YR, value of 3, and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. The E, Bhs, and Bs horizons are loam, very fine sandy loam, fine sandy loam, or silt loam. The E part of the E/Bx and B/Ex horizons has hue of 5YR or 7.5YR, value of 4 to 7, and chroma of 2 to 4. It is loam, fine sandy loam, or sandy loam. The Bt part has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. It is loam or clay loam. The C horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 3 or 4. It is fine sandy loam, loam, or silt loam.

Halfaday Series

The Halfaday series consists of very deep, moderately well drained, rapidly permeable soils on outwash plains, lake plains, stream terraces, and till plains. These soils formed in sandy material. Slopes range from 0 to 3 percent.

Typical pedon of Halfaday sand, 0 to 3 percent slopes, 1,000 feet north and 150 feet east of the southwest corner of sec. 34, T. 55 N., R. 35 W.

Oe—1 inch to 0; black (5YR 2/1), partially decomposed forest litter; many roots; abrupt smooth boundary.

E—0 to 3 inches; pinkish gray (5YR 6/2) sand; weak medium subangular blocky structure parting to weak medium granular; very friable; common roots; about 2 percent gravel; very strongly acid; abrupt wavy boundary.

Bhs—3 to 6 inches; dark reddish brown (5YR 3/3) sand; weak medium subangular blocky structure parting to weak medium granular; friable; many roots; about 2 percent gravel; strongly acid; abrupt broken boundary.

Bs1—6 to 10 inches; yellowish red (5YR 4/6) sand; weak medium subangular blocky structure parting to weak medium granular; friable; many roots; about 2 percent gravel; strongly acid; abrupt wavy boundary.

Bs2—10 to 15 inches; strong brown (7.5YR 4/6) sand; weak fine subangular blocky structure parting to weak fine granular; friable; common roots; about 2 percent gravel; common pockets of ortstein; strongly acid; clear broken boundary.

BC—15 to 30 inches; strong brown (7.5YR 5/6) sand; massive; friable; few roots; about 10 percent gravel; strongly acid; abrupt smooth boundary.

C—30 to 60 inches; light brown (7.5YR 6/4) sand; common coarse distinct strong brown (7.5YR 5/6 and 5/8) mottles; massive; friable; few roots; about 2 percent coarse fragments; medium acid.

The thickness of the solum ranges from 30 to 45 inches. The content of gravel ranges from 0 to 10 percent.

The A horizon, if it occurs, has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. The E horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. The C horizon has value of 5 to 7 and chroma of 3 to 6.

Jacobsville Series

The Jacobsville series consists of moderately deep, poorly drained, moderately permeable soils on till plains and sandstone benches. These soils formed in loamy and sandy glacial till over sandstone bedrock. Slopes are 0 to 2 percent.

Typical pedon of Jacobsville muck, 1,800 feet north and 1,900 feet west of the southeast corner of sec. 36, T. 55 N., R. 32 W.

Oa—0 to 5 inches; black (N 2/0) muck; weak fine subangular blocky structure; very friable; many roots; strongly acid; abrupt smooth boundary.

Eg—5 to 9 inches; dark reddish gray (5YR 4/2) sandy loam; common medium prominent strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; friable; few roots; about 5 percent gravel; strongly acid; clear wavy boundary.

Bw—9 to 23 inches; dark reddish brown (2.5YR 3/4) sandy loam; common medium prominent dark brown (7.5YR 4/2) and few fine prominent strong brown (7.5YR 4/6) mottles; weak fine and medium subangular blocky structure; friable; about 5 percent gravel; medium acid; clear wavy boundary.

C—23 to 36 inches; reddish brown (2.5YR 4/4) sandy loam; many medium prominent dark reddish gray (5YR 4/2), common medium prominent pinkish gray (7.5YR 6/2), and few medium prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; about 5 percent gravel; medium acid; clear smooth boundary.

2R—36 inches; reddish brown (2.5YR 4/4) sandstone bedrock.

The depth to bedrock and the thickness of the solum range from 20 to 40 inches. The volume of gravel or sandstone fragments ranges from 0 to 10 percent in the solum and from 0 to 60 percent in the C horizon.

The Oa horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Some pedons have an A horizon. The A horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. The A horizon is dominantly mucky sandy loam, but the range includes mucky fine sandy loam and mucky loamy sand. The Eg horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 1 or 2. It is loamy sand or sandy loam. The Bw horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 3 or 4. The C horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is sandy loam, loamy sand, or the channery or very channery analogs of those textures.

Kalkaska Series

The Kalkaska series consists of very deep, somewhat excessively drained, rapidly permeable soils on outwash plains, till plains, and moraines. These soils formed in sandy glacial drift. Slopes range from 0 to 70 percent.

Typical pedon of Kalkaska sand, in an area of Kalkaska-Waiska sands, 0 to 8 percent slopes; 1,400 feet north and 500 feet east of the southwest corner of sec. 12, T. 54 N., R. 35 W.

Oe—1 inch to 0; black (N 2/0), partially decomposed forest litter; many roots; abrupt smooth boundary.

E—0 to 3 inches; reddish gray (5YR 5/2) sand; weak fine subangular blocky structure; very friable; many roots; about 2 percent gravel; strongly acid; clear wavy boundary.

Bhs1—3 to 6 inches; dark reddish brown (5YR 3/2) sand; weak medium subangular blocky structure; friable; many roots; about 2 percent gravel; very strongly acid; clear irregular boundary.

Bhs2—6 to 11 inches; dark reddish brown (5YR 3/3) sand; weak fine subangular blocky structure; very friable; many roots; about 2 percent gravel; strongly acid; clear wavy boundary.

Bs1—11 to 15 inches; dark reddish brown (5YR 3/4) sand; weak fine subangular blocky structure; very friable; common roots; about 2 percent gravel; strongly acid; clear wavy boundary.

Bs2—15 to 19 inches; dark brown (7.5YR 4/4) sand; weak fine subangular blocky structure; very friable; common roots; about 8 percent gravel; strongly acid; clear smooth boundary.

BC—19 to 28 inches; strong brown (7.5YR 5/6) sand; single grained; loose; few roots; about 8 percent gravel; strongly acid; gradual smooth boundary.

C—28 to 60 inches; brown (7.5YR 5/4) sand; single grained; loose; few roots; about 2 percent gravel; medium acid.

The thickness of the solum ranges from 24 to 48 inches. The content of gravel ranges from 0 to 10 percent.

The A horizon, if it occurs, has hue of 5YR to 10YR and value and chroma of 2 or 3. The E horizon has hue of 5YR to 10YR and value of 5 or 6. The Bhs horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 4 to 6. Some pedons have as much as 30 percent ortstein in the B horizons. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 3 or 4.

Kallio Series

The Kallio series consists of very deep, moderately well drained soils on till plains and moraines. These soils formed in a loamy mantle over glacial till. They have a fragipan. Permeability is moderate in the silty mantle, very slow in the fragipan, and moderately slow in the underlying material. Slopes range from 1 to 8 percent.

Typical pedon of Kallio cobbly very fine sandy loam, 1 to 8 percent slopes, 2,445 feet west and 380 feet north of the southeast corner of sec. 16, T. 47 N., R. 36 W.

A—0 to 3 inches; black (5YR 2/1) cobbly very fine sandy loam, dark gray (5YR 4/1) dry; moderate fine granular structure; friable; many roots; about 16 percent cobbles; medium acid; abrupt smooth boundary.

E—3 to 5 inches; reddish gray (5YR 5/2) cobbly very fine sandy loam; weak medium platy structure parting to weak very fine subangular blocky; friable; many roots; about 16 percent cobbles; medium acid; abrupt wavy boundary.

Bs1—5 to 13 inches; dark reddish brown (5YR 3/4) very fine sandy loam; weak fine subangular blocky structure; friable; common roots; about 10 percent cobbles; strongly acid; clear wavy boundary.

Bs2—13 to 22 inches; reddish brown (5YR 4/4) very fine sandy loam; few fine distinct yellowish red (5YR 5/8) mottles; weak fine subangular blocky structure; friable; common roots; about 10 percent cobbles; medium acid; abrupt wavy boundary.

E/Bx—22 to 27 inches; about 60 percent reddish brown (5YR 5/3) very fine sandy loam (E); few fine prominent yellowish red (5YR 5/8) mottles; surrounding peds of reddish brown (2.5YR 4/4) loam (Bt); weak medium subangular blocky structure; very firm; few roots; many pores; few distinct clay films; about 8 percent gravel; medium acid; clear wavy boundary.

2B/Ex—27 to 36 inches; about 85 percent reddish brown (2.5YR 4/4) loam (Bt); common distinct clay films; surrounded by reddish brown (5YR 5/3) very fine sandy loam (E); weak medium subangular blocky structure; very firm; few roots; common pores; about 8 percent gravel; medium acid; clear wavy boundary.

2C—36 to 60 inches; reddish brown (5YR 4/4) loam; massive; friable; about 8 percent gravel; slightly acid.

The thickness of the solum ranges from 30 to 55 inches. Depth to the fragipan ranges from 12 to 22 inches. The content of gravel ranges from 0 to 10 percent in the solum and from 0 to 20 percent in the 2C horizon. The content of cobbles ranges from 15 to 30 percent in the A and E horizons and from 0 to 10 percent in the remainder of the profile.

The A horizon has hue of 5YR or 7.5YR and chroma of 1 or 2. The E horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. It is cobbly very fine sandy loam, cobbly silt loam, or cobbly fine sandy loam.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. It is silt loam, very fine sandy loam, or fine sandy loam. The E part of the 2E/Bx and 2B/Ex horizons has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is very fine sandy loam, fine sandy loam, or silt loam. The B part of these horizons and the 2Bt horizon, if it occurs, have hue of 2.5YR or 5YR and chroma of 2 to 4. They are loam, clay loam, silty clay loam, or silt loam. The 2C horizon has hue of 2.5YR or 5YR and chroma of 2 to 4.

Karlin Series

The Karlin series consists of very deep, somewhat

excessively drained soils on outwash plains and moraines. These soils formed in a loamy mantle over sandy glacial outwash. Permeability is moderately rapid in the subsoil and rapid in the substratum. Slopes range from 1 to 15 percent.

The Karlin soils in this survey area have thicker Bhs horizons than is definitive for the series. This difference, however, does not alter the use and management of the soils.

Typical pedon of Karlin fine sandy loam, in an area of Karlin-Kalkaska complex, 0 to 8 percent slopes; 1,890 feet north and 380 feet west of the southeast corner of sec. 3, T. 49 N., R. 37 W.

Oa—1 inch to 0; black (N 2/0), well decomposed forest litter; many roots; abrupt smooth boundary.

E—0 to 3 inches; dark gray (5YR 4/1) fine sandy loam; weak fine subangular blocky structure; friable; many roots; about 3 percent gravel; very strongly acid; abrupt wavy boundary.

Bhs—3 to 6 inches; dark brown (7.5YR 3/2) fine sandy loam; weak fine subangular blocky structure; friable; many roots; about 3 percent gravel; very strongly acid; clear wavy boundary.

Bs1—6 to 14 inches; dark brown (7.5YR 3/4) fine sandy loam; weak fine subangular blocky structure; friable; common roots; about 3 percent gravel; strongly acid; clear wavy boundary.

Bs2—14 to 21 inches; brown (7.5YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable; common roots; about 3 percent gravel; strongly acid; clear wavy boundary.

2BC—21 to 34 inches; brown (7.5YR 4/6) sand; single grained; loose; few roots; about 10 percent gravel; strongly acid; clear wavy boundary.

2C—34 to 60 inches; strong brown (7.5YR 5/6) sand; single grained; loose; few roots; about 10 percent gravel; strongly acid.

The thickness of the solum ranges from 27 to 34 inches. The soil has 0 to 10 percent gravel.

The A horizon, if it occurs, has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. The E horizon has chroma of 1 or 2.

The Bhs horizon has hue of 5YR or 7.5YR and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loamy sand and sandy loam. The Bs horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. It is dominantly fine sandy loam, but the range includes loamy sand, fine sand, or sand.

The C horizon has hue of 10YR to 5YR, value of 4 to 7, and chroma of 2 to 6. It is dominantly sand, but some pedons have thin discontinuous layers of loamy sand or sandy loam below a depth of 40 inches.

Keweenaw Series

The Keweenaw series consists of very deep, well drained or moderately well drained, moderately permeable or moderately rapidly permeable soils on till plains and moraines. These soils formed in sandy, water-worked glacial till. Slopes range from 1 to 70 percent.

Typical pedon of Keweenaw gravelly loamy sand, in an area of Keweenaw-Kalkaska complex, 1 to 8 percent slopes; 2,300 feet west and 400 feet north of the southeast corner of sec. 31, T. 56 N., R. 34 W.

A—0 to 2 inches; black (5YR 2/1) gravelly loamy sand, dark gray (5YR 4/1) dry; moderate very fine granular structure; very friable; many fine and medium roots; many uncoated sand grains; about 15 percent gravel and 10 percent cobbles; strongly acid; abrupt smooth boundary.

Bhs—2 to 8 inches; dark reddish brown (5YR 3/3) gravelly loamy sand; moderate fine subangular blocky structure; very friable; common fine and medium roots; about 15 percent gravel and 10 percent cobbles; strongly acid; clear broken boundary.

Bs1—8 to 15 inches; dark reddish brown (5YR 3/4) gravelly loamy sand; weak fine subangular blocky structure; very friable; common fine and medium roots; about 15 percent gravel and 10 percent cobbles; strongly acid; clear wavy boundary.

Bs2—15 to 25 inches; reddish brown (5YR 4/4) gravelly loamy sand; weak fine subangular blocky structure; friable; common fine and medium roots; about 15 percent gravel and 10 percent cobbles; strongly acid; clear wavy boundary.

B/E—25 to 47 inches; about 70 percent reddish brown (2.5YR 4/4) fine sandy loam (Bt); firm; clay bridges between sand grains and clay films on faces of pebbles; surrounded by light reddish brown (5YR 6/3) loamy fine sand (E); weak thin platy structure parting to weak fine subangular blocky; firm; few roots; about 10 percent gravel and 2 percent cobbles; common pores; strongly acid; clear wavy boundary.

C—47 to 60 inches; reddish brown (5YR 5/4) loamy sand; few strata of fine sand and sand; weak thin platy structure parting to weak very fine subangular blocky; friable; medium acid.

The thickness of the solum ranges from 30 to 55 inches. The content of gravel ranges from 0 to 20 percent. The content of cobbles ranges from 0 to 15 percent.

The A horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon, if it occurs, has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2.

The Bhs horizon has hue of 5YR or 7.5YR, value of 3, and chroma of 2 or 3. The Bs horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 2 to 6. The Bhs and Bs horizons are loamy sand, loamy fine sand, sand, or the gravelly analogs of those textures. The Bt part of the B/E horizon has hue of 2.5YR or 5YR and value and chroma of 3 or 4. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or the gravelly analogs of those textures. The E part has hue of 2.5YR to 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is sand, loamy sand, or loamy fine sand. In some pedons the B/E horizon has weak characteristics of a fragipan.

The C horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6. It ranges dominantly from uniform loamy sand to water-worked, interbedded fine sand, sand, and loamy sand, but bands or pockets of sandy loam are in some pedons.

Kinross Series

The Kinross series consists of very deep, poorly drained, rapidly permeable soils on outwash plains, lake plains, and till plains. These soils formed in sandy glacial drift. Slopes are 0 to 2 percent.

Typical pedon of Kinross muck, in an area of Kinross-Dawson complex; 3,400 feet south and 1,250 feet east of the northwest corner of sec. 8, T. 55 N., R. 31 W.

Oa—0 to 3 inches; black (N 2/0) muck; weak fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

E—3 to 9 inches; pinkish gray (7.5YR 6/2) sand; weak fine subangular blocky structure; very friable; few roots; very strongly acid; abrupt wavy boundary.

Bs—9 to 14 inches; brown (7.5YR 4/4) sand; few fine distinct dark brown (7.5YR 4/2) mottles; weak fine subangular blocky structure; very friable; few roots; strongly acid; clear wavy boundary.

Bhs—14 to 23 inches; dark reddish brown (5YR 3/2) sand; weak fine subangular blocky structure; very friable; few roots; very strongly acid; clear wavy boundary.

Bs′—23 to 37 inches; dark reddish brown (5YR 3/4) sand; few fine prominent dark brown (7.5YR 4/2) and strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; very friable; strongly acid; gradual wavy boundary.

BC—37 to 49 inches; reddish brown (5YR 4/3) sand; single grained; loose; strongly acid; gradual wavy boundary.

C—49 to 60 inches; brown (7.5YR 4/2) sand; single grained; loose; about 5 percent gravel; strongly acid.

The thickness of the solum ranges from 24 to 50 inches. Some pedons have an A horizon as much as 6 inches thick. This horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is sand or mucky sand. The E horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. The Bhs horizon has value and chroma of 2 or 3. The Bs and Bs′ horizons have hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. The C horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 or 4.

Liminga Series

The Liminga series consists of very deep, well drained, rapidly permeable soils on old beach ridges, dunes, outwash plains, kames, and moraines. These soils formed in sandy glaciofluvial sediments. Slopes range from 0 to 70 percent.

Typical pedon of Liminga fine sand, 0 to 8 percent slopes, 2,550 feet east and 1,100 feet north of the southwest corner of sec. 11, T. 55 N., R. 35 W.

Oa—1 inch to 0; black (N 2/0), well decomposed leaf litter that has a small amount of fine sand; many roots; abrupt smooth boundary.

E—0 to 10 inches; light reddish brown (5YR 6/3) fine sand; weak granular structure; very friable; many fine to coarse roots; strongly acid; abrupt irregular boundary.

Bhs—10 to 18 inches; dark reddish brown (5YR 3/2) fine sand; weak medium subangular blocky structure; very friable; few fragments of strongly cemented ortstein; many fine and medium roots; very strongly acid; gradual irregular boundary.

Bs1—18 to 28 inches; reddish brown (5YR 4/4) fine sand; weak fine subangular blocky structure; very friable; common fine roots; few fragments of strongly cemented ortstein; medium acid; clear wavy boundary.

Bs2—28 to 39 inches; yellowish red (5YR 4/6) fine sand; weak fine subangular blocky structure; very friable; medium acid; gradual wavy boundary.

C—39 to 60 inches; reddish yellow (5YR 6/6) fine sand; single grained; loose; medium acid.

The thickness of the solum ranges from 26 to 55 inches. The content of gravel ranges from 0 to 5 percent throughout the profile. Some pedons have an A horizon. It has hue of 10YR to 5YR, value of 2 or 3, and chroma of 1 to 3. The Oa horizon has hue of 10YR to 5YR, value of 2, and chroma of 1, or it is neutral in hue and has value of 2. The E horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 1 to 3.

The Bhs horizon has hue of 5YR or 7.5YR, value of 3, and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. The B horizon is dominantly fine sand, but the range includes very fine sand and loamy fine sand.

The C horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. Some pedons have thin bands of loamy fine sand.

Loxley Series

The Loxley series consists of very deep, very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on lake plains, outwash plains, and till plains. These soils formed in mainly herbaceous organic material. Slopes are 0 to 1 percent.

Typical pedon of Loxley peat, in an area of Dawson and Loxley peats; 2,650 feet north and 600 feet west of the southeast corner of sec. 22, T. 55 N., R. 35 W.

Oi—0 to 5 inches; dark yellowish brown (10YR 3/4) peat; 100 percent fiber, 100 percent rubbed; massive; primarily live roots and sphagnum moss; extremely acid; clear smooth boundary.

Oa1—5 to 12 inches; muck, black (10YR 2/1) broken face and rubbed; about 30 percent fiber, 10 percent rubbed; nonsticky; primarily herbaceous fibers, a few woody fibers; extremely acid; gradual smooth boundary.

Oa2—12 to 26 inches; muck, very dark brown (10YR 2/2) broken face and rubbed; about 10 percent fiber, 2 percent rubbed; nonsticky; primarily herbaceous fibers, a few woody fibers; extremely acid; gradual smooth boundary.

Oa3—26 to 38 inches; muck, very dark brown (10YR 2/2) broken face and rubbed; about 15 percent fiber, 2 percent rubbed; massive; nonsticky; primarily herbaceous fibers; extremely acid; gradual smooth boundary.

Oa4—38 to 45 inches; muck, dark brown (7.5YR 3/4) broken face and very dark brown (10YR 2/2) rubbed; about 60 percent fiber, 10 percent rubbed; massive; nonsticky; primarily herbaceous fibers; extremely acid; gradual smooth boundary.

Oe—45 to 60 inches; mucky peat, brown (7.5YR 4/4) broken face and rubbed; about 90 percent fiber, 30 percent rubbed; massive; nonsticky; primarily herbaceous fibers; extremely acid.

The organic layers are more than 51 inches thick. The surface tier is dominantly peat derived from sphagnum moss, but in some pedons it is composed of mucky peat or muck. The remaining tiers are dominantly muck derived from herbaceous plants. Thin layers of woody material or mucky peat are in some pedons. The organic material has hue of 5YR to 10YR, value of 2 to 5, and chroma of 1 to 4.

Lupton Series

The Lupton series consists of very deep, very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on till plains, outwash plains, and moraines. These soils formed in well decomposed woody and herbaceous material. Slopes are 0 to 1 percent.

Typical pedon of Lupton muck, in an area of Lupton and Cathro mucks; 2,600 feet north and 30 feet west of the southeast corner of sec. 30, T. 54 N., R. 32 W.

Oa1—0 to 8 inches; muck, black (10YR 2/1) broken face and rubbed; about 5 percent fiber, 2 percent rubbed; weak fine granular structure; nonsticky; many roots; primarily woody fibers; slightly acid; clear smooth boundary.

Oa2—8 to 34 inches; muck, very dark brown (10YR 2/2) broken face and rubbed; about 30 percent fiber, 10 percent rubbed; massive; nonsticky; primarily woody fibers; slightly acid; clear smooth boundary.

Oa3—34 to 60 inches; muck, black (10YR 2/1) broken face and rubbed; about 20 percent fiber, 5 percent rubbed; massive; nonsticky; primarily woody fibers; slightly acid.

The organic layers are more than 51 inches thick. The soils are dominantly muck. Some pedons have layers of mucky peat less than 10 inches thick. Woody fragments comprising as much as 30 percent of the volume in some pedons are mixed throughout the control section in the form of twigs, branches, logs, or stumps. The organic material has hue of 5YR to 10YR,

value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3.

Manistee Series

The Manistee series consists of very deep, moderately well drained soils on lake plains. These soils formed in sandy material underlain by clayey lacustrine material. Permeability is rapid in the sandy material and very slow in the clayey layers. Slopes range from 1 to 8 percent.

Typical pedon of Manistee sand, in an area of Manistee-Ontonagon complex, dissected, 1 to 12 percent slopes; 250 feet south and 60 feet west of the northeast corner of sec. 6, T. 52 N., R. 34 W.

Ap—0 to 7 inches; dark brown (7.5YR 3/2) sand, brown (7.5YR 5/2) dry; weak medium subangular blocky structure parting to weak medium granular; very friable; many roots; medium acid; abrupt smooth boundary.

E—7 to 11 inches; brown (7.5YR 5/2) sand; moderate medium subangular blocky structure; very friable; many roots; medium acid; clear wavy boundary.

Bs1—11 to 16 inches; dark brown (7.5YR 3/4) sand; moderate medium subangular blocky structure; friable; common roots; discontinuous strongly cemented ortstein; medium acid; clear wavy boundary.

Bs2—16 to 33 inches; brown (7.5YR 4/4) sand; few medium distinct brown (7.5YR 4/2) mottles; weak medium subangular blocky structure; very friable; common roots; some weak discontinuous ortstein; medium acid; clear smooth boundary.

2Bt—33 to 50 inches; reddish brown (2.5YR 4/4) silty clay; few medium prominent brown (7.5YR 4/2) mottles; weak medium subangular blocky structure; firm; common clay films on faces of peds; neutral; gradual smooth boundary.

2C—50 to 60 inches; reddish brown (2.5YR 4/4) silty clay loam; massive; firm; neutral.

The thickness of the sandy material ranges from 20 to 40 inches. The sandy layers have 0 to 5 percent gravel.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 1 or 2. Some pedons have an A horizon. It has colors similar to those of the Ap horizon. The E horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. It is sand, fine sand, or loamy sand.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 to 6. It is sand, fine sand, or loamy sand. Some pedons have a thin E′ horizon above the clay.

The 2Bt horizon has hue of 2.5YR or 5YR. It is clay or silty clay.

The 2C horizon has hue of 2.5YR to 7.5YR. It is clay, silty clay, or silty clay loam.

Michigamme Series

The Michigamme series consists of moderately deep, well drained or moderately well drained, moderately permeable soils on rocky knolls, till plains, and moraines underlain by bedrock. These soils formed in a loamy mantle over loamy glacial till underlain by igneous and metamorphic bedrock. Slopes range from 0 to 35 percent.

Typical pedon of Michigamme cobbly fine sandy loam, in an area of Trimountain-Paavola-Michigamme complex, dissected, 1 to 12 percent slopes, rocky; 2,025 feet west and 10 feet south of the northeast corner of sec. 19, T. 56 N., R. 32 W.

A—0 to 3 inches; dark reddish brown (5YR 2/2) cobbly fine sandy loam, dark reddish gray (5YR 4/2) dry; weak fine and medium subangular blocky structure; friable; many roots; about 5 percent gravel and 15 percent cobbles; strongly acid; abrupt smooth boundary.

E—3 to 4 inches; reddish brown (5YR 4/3) cobbly fine sandy loam; moderate medium subangular blocky structure; friable; many roots; about 5 percent gravel and 15 percent cobbles; medium acid; abrupt broken boundary.

Bhs—4 to 8 inches; dark reddish brown (5YR 3/3) fine sandy loam; moderate fine and medium subangular blocky structure; friable; many roots; about 5 percent gravel and 10 percent cobbles; medium acid; clear wavy boundary.

Bs—8 to 12 inches; dark reddish brown (5YR 3/4) fine sandy loam; moderate fine and medium subangular blocky structure; friable; common roots; about 5 percent gravel and 10 percent cobbles; medium acid; clear smooth boundary.

2BC—12 to 29 inches; reddish brown (5YR 4/4) cobbly sandy loam; common medium distinct yellowish red (5YR 4/6) mottles; moderate medium platy structure parting to weak very fine subangular blocky; firm; about 15 percent gravel and 15 percent cobbles; medium acid; abrupt smooth boundary.

3R—29 inches; igneous bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The soil has 0 to 15 percent gravel and 0 to 35 percent cobbles.

The A horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 to 3. The E horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3. It is dominantly cobbly fine sandy loam, but the range includes cobbly very fine sandy loam.

The Bhs horizon has value and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR and value and chroma of 3 to 6. These horizons are fine sandy loam, sandy loam, or the gravelly or cobbly analogs of those textures. Some pedons have a weak fragipan above the bedrock. It has colors and textures similar to those of the B horizons. The underlying bedrock is igneous or metamorphic.

Misery Series

The Misery series consists of very deep, somewhat poorly drained soils on ground moraines, end moraines, and relict lake basins. These soils formed in loamy glacial till. They have a fragipan. Permeability is moderate in the upper part of the subsoil, very slow in the fragipan, and moderate or moderately slow in the underlying material. Slopes range from 0 to 3 percent.

Typical pedon of Misery very fine sandy loam, in an area of Graveraet-Misery complex, 0 to 8 percent slopes; 2,100 feet east and 160 feet south of the northwest corner of sec. 7, T. 52 N., R. 36 W.

A—0 to 4 inches; black (5YR 2/1) very fine sandy loam, light gray (5YR 6/1) dry; weak fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

E—4 to 7 inches; dark reddish gray (5YR 4/2) very fine sandy loam; common medium faint reddish gray (5YR 5/2) mottles; weak fine subangular blocky structure; friable; many roots; very strongly acid; clear wavy boundary.

Bs—7 to 11 inches; reddish brown (5YR 4/4) very fine sandy loam; common medium distinct dark reddish gray (5YR 4/2) and common fine distinct yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; friable; common roots; strongly acid; clear wavy boundary.

B/Ex—11 to 22 inches; about 60 percent reddish brown (2.5YR 4/4) loam (Bt); common prominent clay films on faces of peds; surrounded by light brown (7.5YR 6/4) fine sandy loam (E); many medium prominent reddish gray (5YR 5/2) and common fine prominent yellowish red (5YR 4/6) mottles; weak thick platy structure; very firm; few fine roots; strongly acid; clear wavy boundary.

Btx—22 to 38 inches; reddish brown (2.5YR 4/4) loam; common medium prominent reddish gray (5YR 5/2) and common fine prominent yellowish red (5YR 5/8) mottles; weak medium platy structure; very firm; common prominent clay films on faces of peds; few roots; neutral; clear smooth boundary.

C—38 to 60 inches; reddish brown (2.5YR 4/4) loam; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 45 inches. The content of gravel ranges from 0 to 10 percent. The content of cobbles ranges from 0 to 5 percent.

The A horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. Pedons in cultivated areas have an Ap horizon. The E horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2. It is very fine sandy loam, loam, or silt loam.

The Bs horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, silt loam, very fine sandy loam, or fine sandy loam. The E part of the B/Ex horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. The B part has hue of 2.5YR or 5YR and value and chroma of 3 or 4. It is fine sandy loam, loam, and silt loam.

The C horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It is loam or fine sandy loam.

Munising Series

The Munising series consists of very deep, moderately well drained or well drained soils on till plains and moraines. These soils formed in loamy glacial till. They have a fragipan. Permeability is moderate in the upper part of the profile, very slow in the fragipan, and moderate in the underlying material. Slopes range from 1 to 70 percent.

Typical pedon of Munising loamy fine sand, dissected, 1 to 12 percent slopes, 350 feet south of the northeast corner of sec. 12, T. 53 N., R. 34 W.

A—0 to 2 inches; dark gray (5YR 4/1) loamy fine sand, gray (5YR 5/1) dry; weak fine subangular blocky structure; very friable; many roots; medium acid; abrupt smooth boundary.

E—2 to 12 inches; pinkish gray (5YR 6/2) loamy fine

sand; weak fine subangular blocky structure; very friable; many roots; medium acid; abrupt smooth boundary.

Bhs—12 to 14 inches; dark reddish brown (5YR 3/2) fine sandy loam; weak fine and medium subangular blocky structure; friable; many roots; about 3 percent gravel; medium acid; clear smooth boundary.

Bs—14 to 25 inches; reddish brown (5YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable; few roots; about 3 percent gravel; medium acid; clear smooth boundary.

B/Ex—25 to 48 inches; about 60 percent reddish brown (2.5YR 4/4) sandy loam (Bt); common fine and medium pores; common clay films on faces of peds; surrounded by light reddish brown (5YR 6/4) loamy sand (E); common fine prominent reddish yellow (5YR 6/8) mottles; moderate thick platy structure; very firm; about 8 percent gravel; medium acid; clear smooth boundary.

C—48 to 60 inches; reddish brown (2.5YR 4/4) sandy loam; massive; friable; about 5 percent gravel; medium acid.

The thickness of the solum ranges from 34 to more than 80 inches. Depth to the fragipan ranges from 15 to 24 inches. The soil has 2 to 10 percent gravel and 0 to 5 percent cobbles.

The A horizon has hue of 5YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2, or it is neutral in hue and has value of 2 to 4. The E horizon has hue of 5YR or 7.5YR and value of 5 or 6. It is fine sandy loam, loamy sand, or loamy fine sand.

The Bhs horizon has value and chroma of 2 or 3. The Bs horizon has value and chroma of 3 or 4. Only one of these horizons is present in some pedons. The Bs2 horizon, if it occurs, has value of 3 or 4 and chroma of 3 to 6. The B horizon is loamy fine sand, sandy loam, or fine sandy loam. The E part of the B/Ex horizon has value of 4 to 6 and chroma of 2 to 4. It is loamy sand, loamy fine sand, sandy loam, or fine sandy loam. The B part has hue of 2.5YR or 5YR and value of 3 to 5. It is sandy loam, fine sandy loam, or sandy clay loam.

The C horizon has hue of 10R to 5YR, value of 4 or 5, and chroma of 3 or 4. It is sandy loam or fine sandy loam.

Net Series

The Net series consists of very deep, somewhat poorly drained soils on till plains and moraines. These soils formed in a loamy mantle and in the underlying loamy or sandy glacial till. They have a fragipan. Permeability is moderate above the fragipan, very slow in the fragipan, and moderate or moderately rapid in the underlying material. Slopes range from 0 to 3 percent.

Typical pedon of Net stony fine sandy loam, in an area of Net-Witbeck complex, 0 to 3 percent slopes; 1,150 feet south and 300 feet east of the northwest corner of sec. 30, T. 55 N., R. 33 W.

A—0 to 5 inches; very dark brown (10YR 2/2) stony fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many roots; about 5 percent gravel, 6 percent cobbles, and 15 percent stones; medium acid; abrupt smooth boundary.

Bhs—5 to 9 inches; dark reddish brown (5YR 3/3) fine sandy loam; weak medium subangular blocky structure; friable; common roots; about 5 percent gravel and 6 percent cobbles; strongly acid; clear wavy boundary.

Bs—9 to 16 inches; dark reddish brown (5YR 3/4) fine sandy loam; few fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; about 5 percent gravel and 6 percent cobbles; strongly acid; abrupt wavy boundary.

E/Bx—16 to 24 inches; about 60 percent reddish brown (5YR 4/3) gravelly fine sandy loam (E); common fine distinct yellowish red (5YR 5/6) mottles; surrounding peds of dark reddish brown (5YR 3/4) fine sandy loam (Bt); moderate thick platy structure; firm; common fine vesicular pores; about 11 percent gravel and 5 percent cobbles; medium acid; gradual wavy boundary.

2BC—24 to 36 inches; reddish brown (5YR 4/4) gravelly loamy sand; common fine distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; friable; about 13 percent gravel and 5 percent cobbles; slightly acid; gradual wavy boundary.

2C—36 to 60 inches; reddish brown (5YR 4/3) gravelly loamy sand; common fine distinct yellowish red (5YR 5/6) mottles; massive; friable; about 15 percent gravel and 5 percent cobbles; slightly acid.

The thickness of the solum ranges from 25 to 46 inches. Depth to the fragipan ranges from 15 to 24 inches. The content of cobbles ranges from 5 to 10 percent. The content of stones ranges from 15 to 20 percent in the surface layer. The content of gravel ranges from 5 to 35 percent.

Some pedons have an O horizon. It has hue of 5YR or 7.5YR and chroma of 1 or 2.

The A horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. It is fine sandy loam or silt loam. The E horizon, if it occurs, has hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3. It is fine sandy loam, very fine sandy loam, or the gravelly analogs of those textures.

The Bhs and Bs horizons have hue of 5YR to 10YR and value and chroma of 2 to 4. They are fine sandy loam, silt loam, or the gravelly analogs of those textures. The E/Bx horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. The E/Bx and 2C horizons are gravelly sandy loam, gravelly loamy sand, or gravelly fine sandy loam.

Nunica Series

The Nunica series consists of very deep, well drained, moderately slowly permeable soils on lake plains. These soils formed in silty lacustrine deposits. Slopes range from 1 to 35 percent.

The Nunica soils in this survey area have tongues of E material in the B horizon, which are outside the range for the series. This difference, however, does not alter the use and management of the soils.

Typical pedon of Nunica silt loam, in an area of Nunica-Fence complex, dissected, 8 to 35 percent slopes; 2,265 feet north and 450 feet west of the southeast corner of sec. 1, T. 47 N., R. 36 W.

A—0 to 3 inches; reddish brown (5YR 4/3) silt loam, pinkish gray (5YR 6/2) dry; moderate fine granular structure; friable; many roots; strongly acid; clear wavy boundary.

E/B—3 to 9 inches; about 60 percent brown (7.5YR 5/2) silt loam (E); extending into or completely surrounding isolated remnants of reddish brown (5YR 4/4) silty clay loam (Bt); weak medium subangular blocky structure; firm; common roots; common prominent reddish brown (2.5YR 4/4) clay films on faces of peds and in root channels; medium acid; clear wavy boundary.

B/E—9 to 21 inches; about 70 percent reddish brown (2.5YR 4/4) silty clay loam (Bt); moderate medium and coarse subangular blocky structure; firm; common roots; common distinct clay films on faces of peds and in root channels; completely surrounded by or penetrated by tongues of reddish gray (5YR 5/2) silt loam (E); common roots; medium acid; clear wavy boundary.

C1—21 to 29 inches; stratified red (2.5YR 4/4) silt loam and reddish brown (5YR 5/4) silty clay loam; weak medium platy structure; friable; few roots; few clay flows; medium acid; gradual smooth boundary.

C2—29 to 60 inches; reddish brown (5YR 4/4), stratified silt loam and silty clay loam; weak medium plates that tend to part along textural lines; friable; slightly acid.

The thickness of the solum ranges from 20 to 40 inches. The A horizon has hue of 5YR or 7.5YR, value of 2 to 4, and chroma of 1 to 3. Pedons in cultivated areas have an Ap horizon.

The E horizon, if it occurs, and the E part of the E/B and B/E horizons have hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. The B part of the E/B and B/E horizons and the Bt horizon, if it occurs, have hue of 2.5YR or 5YR and chroma of 3 or 4. The C horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 2 to 4.

Ocqueoc Series

The Ocqueoc series consists of very deep, moderately well drained soils on lake plains and outwash plains. These soils formed in sandy material over loamy lacustrine deposits. Permeability is rapid in the upper part of the profile and moderately slow in the lower part. Slopes range from 0 to 8 percent.

The Ocqueoc soils in this survey area have a thicker Bhs horizon than is definitive for the series. This difference, however, does not alter the use and management of the soils.

Typical pedon of Ocqueoc fine sand, in an area of Oqueoc-Halfaday complex, 0 to 8 percent slopes; 2,600 feet west and 525 feet north of the southeast corner of sec. 33, T. 51 N., R. 36 W.

Oe—1 inch to 0; black (5YR 2/1), partially decomposed forest litter; many roots; abrupt smooth boundary.

E—0 to 4 inches; reddish brown (5YR 5/3) fine sand; weak fine and medium subangular blocky structure; very friable; many roots; strongly acid; clear wavy boundary.

Bhs—4 to 7 inches; dark reddish brown (5YR 3/3) fine sand; weak fine and medium subangular blocky structure; very friable; common roots; strongly acid; clear irregular boundary.

Bs1—7 to 20 inches; dark brown (7.5YR 4/4) fine sand; weak fine and medium subangular blocky structure; very friable; common roots; medium acid; gradual wavy boundary.

Bs2—20 to 28 inches; brown (7.5YR 4/4) fine sand;

common medium faint brown (7.5YR 5/4) mottles; weak fine and medium subangular blocky structure; very friable; common roots; medium acid; clear wavy boundary.

2C—28 to 62 inches; stratified, reddish brown (5YR 4/4) and brown (7.5YR 5/4) loamy fine sand, loamy very fine sand, sand, and very fine sandy loam; common fine prominent strong brown (7.5YR 4/6) and few medium distinct dark reddish gray (5YR 4/2) mottles; moderate thin platy structure; friable; common roots; medium acid.

The thickness of the solum and depth to the 2C horizon range from about 24 to 40 inches. Some pedons have a thin A horizon. It has hue of 5YR to 10YR, value of 2 or 3, and chroma of 2. The E horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. The Bhs horizon has hue of 7.5YR or 5YR and value and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is fine sand, sand, or loamy sand. The 2C horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is stratified very fine sandy loam, loamy very fine sand, very fine sand, fine sand, sand, loamy fine sand, silt, silt loam, or silty clay loam.

Ontonagon Series

The Ontonagon series consists of very deep, well drained, very slowly permeable soils on lake plains. These soils formed in clayey lacustrine deposits. Slopes range from 1 to 35 percent.

Typical pedon of Ontonagon silt loam, 1 to 6 percent slopes, 2,500 feet north and 2,050 feet west of the southeast corner of sec. 32, T. 53 N., R. 34 W.

Ap—0 to 7 inches; dark reddish brown (5YR 3/2) silt loam, reddish gray (5YR 5/2) dry; moderate medium granular structure; friable; many roots; slightly acid; clear smooth boundary.

B/E—7 to 13 inches; about 60 percent reddish brown (2.5YR 4/4) clay (Bt); penetrated by tongues of reddish gray (5YR 5/2) silty clay loam (E); strong medium angular blocky structure; common roots; common distinct clay films on faces of peds; common dark reddish brown (5YR 2/2) worm casts; common roots; slightly acid; clear wavy boundary.

Bt—13 to 24 inches; reddish brown (2.5YR 4/4) clay; strong coarse angular blocky structure; very firm; few roots; common clay films on faces of peds; neutral; clear smooth boundary.

C1—24 to 40 inches; reddish brown (2.5YR 4/4) clay; moderate coarse angular blocky structure; very firm; few roots; common reddish brown (2.5YR 6/4) accumulations of carbonate; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—40 to 60 inches; reddish brown (2.5YR 4/4) clay; weak coarse angular blocky structure parting to weak thin platy; very firm; common light reddish brown (2.5YR 6/4) accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 32 inches. The Ap horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 2 or 3. Pedons in undisturbed areas have an A horizon. It has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. Pedons in undisturbed areas also have an E horizon. It has the same textures and colors as the E part of the B/E horizon. The E part of the B/E horizon has value of 5 or 6. It is clay, silty clay, or silty clay loam. The Bt part of the B/E horizon and the Bt horizon have value of 4 or 5 and chroma of 3 or 4. The C horizon has value of 3 to 5. It is clay or silty clay.

Paavola Series

The Paavola series consists of very deep, moderately well drained or well drained soils on ground moraines and end moraines. These soils formed in gravelly or cobbly sandy deposits and in the underlying loamy or sandy glacial till. Permeability is rapid to moderately rapid in the upper part of the profile and very slow in the lower part. Slopes range from 1 to 60 percent.

Typical pedon of Paavola gravelly coarse sandy loam, in an area of Trimountain-Paavola-Waiska complex, 1 to 8 percent slopes; 250 feet south and 300 feet west of the northeast corner of sec. 15, T. 55 N., R. 33 W.

Oi—2 inches to 0; undecomposed hardwood and coniferous leaf litter.

A—0 to 4 inches; dark reddish brown (5YR 2/2) gravelly coarse sandy loam, pinkish gray (5YR 6/2) dry; moderate medium granular structure; friable; many roots; about 22 percent gravel and 10 percent cobbles; strongly acid; clear smooth boundary.

Bhs—4 to 13 inches; dark reddish brown (5YR 3/3) extremely gravelly coarse sand; weak fine subangular blocky structure; very friable; many roots; about 55 percent gravel and 20 percent cobbles; strongly acid; clear wavy boundary.

Bs1—13 to 19 inches; dark reddish brown (5YR 3/4)

extremely gravelly coarse sand; weak fine subangular blocky structure; very friable; many roots; about 42 percent gravel and 20 percent cobbles; slightly acid; clear wavy boundary.

Bs2—19 to 29 inches; brown to dark brown (7.5YR 4/4) extremely gravelly coarse sand; common fine distinct strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; friable; few roots; about 61 percent gravel and 20 percent cobbles; medium acid; abrupt smooth boundary.

2E/Bx—29 to 36 inches; about 60 percent dark reddish gray (5YR 4/2) gravelly loamy fine sand (E); common fine prominent strong brown (7.5YR 4/6) mottles; surrounding peds of reddish brown (5YR 4/4) gravelly fine sandy loam (B); weak thin platy structure; very firm; common fine vesicular pores; few discontinuous faint reddish brown (5YR 4/3) clay films on faces of peds; about 12 percent gravel and 5 percent cobbles; strongly acid; clear wavy boundary.

2Btx—36 to 57 inches; reddish brown (5YR 4/4) gravelly sandy loam; few fine prominent strong brown (7.5YR 4/6) mottles; weak medium platy structure; very firm; few very fine vesicular pores; few faint reddish brown (5YR 4/3) clay films on faces of peds; about 28 percent gravel and 5 percent cobbles; strongly acid; clear wavy boundary.

2Cd—57 to 70 inches; reddish brown (5YR 4/4) very gravelly sandy loam; weak thin platy structure parting to weak fine subangular blocky; very firm; about 21 percent gravel and 15 percent cobbles; medium acid.

The thickness of the solum ranges from 35 to 72 inches. The thickness of the gravelly and sandy material ranges from 20 to 40 inches. The content of gravel ranges from 15 to 50 percent in the A and E horizons, from 35 to 65 percent in the Bhs and Bs horizons, and from 10 to 65 percent in the rest of the profile. The content of cobbles and stones ranges from 5 to 25 percent in the A horizon and from 5 to 40 percent in the subsoil.

The A horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The E horizon, if it occurs, has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2.

The Bhs horizon has hue of 5YR or 7.5YR and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. The Bhs and Bs horizons are the extremely gravelly or very gravelly analogs of coarse sand, sand, or loamy sand.

The E part of the 2E/Bx horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. The B part of the 2E/Bx and 2Btx horizons has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The 2E/Bx and 2Btx horizons are loamy sand, sandy loam, loamy fine sand, fine sandy loam, or the gravelly or very gravelly analogs of those textures.

The 2Cd horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is the gravelly, very gravelly, or extremely gravelly analogs of sand, loamy sand, or sandy loam.

Pelkie Series

The Pelkie series consists of very deep, moderately well drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Pelkie loamy fine sand, in an area of Sturgeon-Arnheim-Pelkie complex; 1,700 feet south and 200 feet east of the northwest corner of sec. 16, T. 53 N., R. 33 W.

Ap—0 to 7 inches; reddish brown (5YR 4/3) loamy fine sand, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; many roots; strongly acid; abrupt smooth boundary.

C1—7 to 20 inches; reddish brown (5YR 4/4) loamy fine sand; weak fine subangular blocky structure; very friable; common roots; medium acid; clear smooth boundary.

C2—20 to 34 inches; reddish brown (5YR 5/3) fine sand with a thin band of pinkish gray (7.5YR 7/2) loamy fine sand; single grained; loose; few roots; medium acid; clear smooth boundary.

C3—34 to 60 inches; light reddish brown (5YR 6/4) fine sand; few fine distinct yellowish red (5YR 5/6) mottles; single grained; loose; few roots; slightly acid.

The Ap horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. Pedons in uncultivated areas have an A horizon. It has hue of 5YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. The C horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is loamy fine sand, sand, or fine sand. Thin layers of loamy sand to silt are below a depth of 40 inches in some pedons.

Richter Series

The Richter series consists of very deep, somewhat poorly drained, moderately rapidly permeable soils on

lake plains and outwash plains. These soils formed in stratified, loamy and sandy deposits. Slopes range from 0 to 3 percent.

Typical pedon of Richter very fine sandy loam, 0 to 3 percent slopes, 940 feet south and 2,545 feet east of the northwest corner of sec. 4, T. 47 N., R. 36 W.

Oa—4 inches to 0; black (N 2/0), well decomposed forest litter; many roots; abrupt smooth boundary.

E—0 to 5 inches; pinkish gray (5YR 6/2) very fine sandy loam; weak thin platy structure; friable; many roots; very strongly acid; clear wavy boundary.

Bs1—5 to 12 inches; brown (7.5YR 4/4) very fine sandy loam; common medium prominent yellowish red (5YR 5/6 and 5/8) mottles; weak thin platy structure parting to weak very fine subangular blocky; friable; common roots; strongly acid; clear wavy boundary.

Bs2—12 to 24 inches; strong brown (7.5YR 4/6), stratified loamy very fine sand and loamy fine sand; common medium distinct yellowish red (5YR 5/6) and common medium prominent yellowish red (5YR 5/8) mottles; weak thin platy structure parting to weak fine subangular blocky; friable; common roots; strongly acid; clear wavy boundary.

B/E—24 to 41 inches; about 60 percent reddish brown (2.5YR 4/4) fine sandy loam (Bt); few distinct clay films on faces of peds; surrounded by brown (7.5YR 5/4) loamy fine sand (E); common medium prominent yellowish red (5YR 5/6 and 5/8) mottles; weak thin platy structure parting to weak fine subangular blocky; friable; few roots; medium acid; gradual wavy boundary.

C1—41 to 55 inches; strong brown (7.5YR 5/6), stratified fine sand and loamy fine sand; common medium distinct yellowish red (5YR 5/6) and common medium prominent yellowish red (5YR 5/8) mottles; massive; very friable; slightly acid; clear wavy boundary.

C2—55 to 60 inches; brown (7.5YR 5/4), stratified fine sand and loamy fine sand; common medium prominent yellowish red (5YR 5/6 and 5/8) mottles; massive; very friable; neutral.

The thickness of the solum ranges from 23 to 40 inches. Some pedons have an A horizon. It has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. The E horizon has hue of 5YR to 10YR, value of 4 to 7, and chroma of 2 or 3.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. It is very fine sandy loam, loamy very fine sand, or loamy fine sand. The Bt part of the B/E horizon has hue of 2.5YR or 5YR. It is silt loam, very fine sandy loam, or fine sandy loam. The E part has hue of 5YR or 7.5YR and chroma of 3 or 4. It is loamy fine sand, very fine sandy loam, or loamy very fine sand.

The C horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is dominantly stratified loamy fine sand, fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam, and silt loam. Strata of silty clay loam or silty clay are below a depth of 40 inches in some pedons.

Roscommon Series

The Roscommon series consists of very deep, poorly drained or very poorly drained, rapidly permeable soils on outwash plains and lake plains. These soils formed in sandy material. Slopes are 0 to 2 percent.

The Roscommon soils in this survey area have a thicker surface layer and are more acid than is definitive for the series. These differences, however, do not alter the use and management of the soils.

Typical pedon of Roscommon muck, in an area of Tawas-Roscommon mucks; 1,000 feet east and 2,500 feet north of the southwest corner of sec. 18, T. 55 N., R. 31 W.

Oa—0 to 4 inches; black (5YR 2/1) muck; moderate medium granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

A—4 to 6 inches; black (N 2/0) mucky sand, gray (N 5/0) dry; weak fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

C1—6 to 22 inches; light brownish gray (10YR 6/2) sand; single grained; loose; few roots; very strongly acid; gradual wavy boundary.

C2—22 to 40 inches; pale brown (10YR 6/3) sand; single grained; loose; strongly acid; abrupt smooth boundary.

C3—40 to 60 inches; pale brown (10YR 6/3) sand; single grained; loose; about 10 percent gravel; medium acid.

The content of gravel ranges from 0 to 10 percent. The O horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. It is 2 to 6 inches thick.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is dominantly mucky sand, but the range includes sand or loamy sand. Some pedons do not have an A horizon.

The C horizon has hue of 7.5YR or 10YR, value of 4

to 6, and chroma of 2 or 3. It is typically sand, but thin layers of fine sand are in some pedons.

Rubicon Series

The Rubicon series consists of very deep, excessively drained, rapidly permeable soils on outwash plains, lake plains, and moraines. These soils formed in sandy glacial drift. Slopes range from 0 to 15 percent.

Typical pedon of Rubicon sand, 0 to 8 percent slopes, 750 feet east and 100 feet north of the southwest corner of sec. 2, T. 54 N., R. 33 W.

Oa—1 inch to 0; black (N 2/0), well decomposed forest litter that has a small amount of sand; many roots; clear smooth boundary.

E—0 to 4 inches; brown (7.5YR 5/2) sand; weak fine subangular blocky structure; very friable; many roots; strongly acid; clear wavy boundary.

Bs1—4 to 8 inches; dark brown (7.5YR 3/4) sand; weak fine and medium subangular blocky structure; very friable; many roots; strongly acid; clear wavy boundary.

Bs2—8 to 19 inches; brown (7.5YR 4/4) sand; weak fine and medium subangular blocky structure; very friable; common roots; medium acid; gradual smooth boundary.

BC—19 to 28 inches; brown (7.5YR 5/4) sand; weak fine subangular blocky structure; very friable; common roots; medium acid; gradual smooth boundary.

C—28 to 60 inches; light brown (7.5YR 6/4) sand; single grained; loose; few roots; medium acid.

The thickness of the solum ranges from 20 to 40 inches. Some pedons have an A horizon. The E horizon has hue of 5YR to 10YR, value of 5 to 7, and chroma of 1 or 2. The B horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 4 to 6. The C horizon has hue of 5YR to 10YR, value of 5 to 7, and chroma of 3 or 4.

Rudyard Series

The Rudyard series consists of very deep, somewhat poorly drained, very slowly permeable soils on lake plains. These soils formed in clayey lacustrine deposits. Slopes are 0 to 2 percent.

Typical pedon of Rudyard silt loam, 0 to 3 percent slopes, 800 feet south and 150 feet east of the northwest corner of sec. 5, T. 52 N., R. 34 W.

A—0 to 4 inches; dark reddish brown (5YR 3/2) silt loam, brown (7.5YR 5/2) dry; moderate fine granular structure; friable; many roots; slightly acid; clear smooth boundary.

E—4 to 9 inches; reddish gray (5YR 5/2) silt loam; common fine prominent strong brown (7.5YR 4/6) and many medium faint reddish brown (5YR 5/3) mottles; moderate medium subangular blocky structure; friable; common roots; slightly acid; clear wavy boundary.

Bt1—9 to 16 inches; dark reddish brown (2.5YR 3/4) clay; few fine prominent reddish gray (5YR 5/2) and common medium prominent reddish brown (5YR 5/4) mottles; strong medium angular blocky structure; firm; few roots; common faint clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—16 to 24 inches; reddish brown (2.5YR 4/4) clay; common medium distinct reddish brown (5YR 5/4) mottles; moderate coarse angular blocky structure; very firm; few roots; common faint clay films on faces of peds; slightly acid; clear smooth boundary.

C—24 to 60 inches; reddish brown (2.5YR 4/4) clay; weak coarse angular blocky structure; very firm; common medium irregular light reddish brown (2.5YR 6/4) accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The Ap horizon, or the A horizon in undisturbed areas, has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 2.5YR to 10YR, value of 5 or 6, and chroma of 2 or 3. It is silt loam or silty clay loam. The C horizon has value of 4 or 5 and chroma of 3 or 4.

Skanee Series

The Skanee series consists of very deep, somewhat poorly drained soils on till plains. These soils formed in loamy and sandy glacial till. They have a fragipan. Permeability is moderate in the upper part of the subsoil, very slow in the fragipan, and moderate in the underlying material. Slopes range from 0 to 3 percent.

Typical pedon of Skanee fine sandy loam, in an area of Munising-Skanee complex, 0 to 8 percent slopes; 2,700 feet west and 100 feet south of the northeast corner of sec. 34, T. 52 N., R. 36 W.

Oa—2 inches to 0; black (N 2/0), well decomposed leaf litter; many roots; abrupt smooth boundary.

E—0 to 6 inches; pinkish gray (5YR 6/2) fine sandy loam; few fine faint reddish gray (5YR 5/2) mottles; moderate medium subangular blocky structure; friable; few roots; about 3 percent gravel; very strongly acid; abrupt smooth boundary.

Bhs—6 to 12 inches; dark reddish brown (5YR 3/3) fine sandy loam; few medium faint dark reddish brown (5YR 3/4) mottles; moderate medium subangular blocky structure; friable; few roots; about 3 percent gravel; very strongly acid; abrupt smooth boundary.

E/Bx—12 to 29 inches; about 60 percent reddish brown (5YR 5/3) fine sandy loam (E); few fine distinct yellowish red (5YR 5/6) mottles; surrounding peds of reddish brown (5YR 4/4) fine sandy loam (Bt); massive; very firm; common clay films on faces of peds; about 3 percent gravel; strongly acid; clear smooth boundary.

Bt—29 to 40 inches; reddish brown (2.5YR 4/4) sandy clay loam; massive; friable; common clay films on faces of peds; about 3 percent gravel; medium acid; clear smooth boundary.

C—40 to 60 inches; reddish brown (2.5YR 4/4) sandy loam; massive; friable; about 3 percent gravel; medium acid.

The thickness of the solum ranges from 30 to 50 inches. Depth to the fragipan ranges from 12 to 20 inches. The content of gravel and cobbles ranges from 0 to 10 percent.

The A horizon, if it occurs, has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 to 4. The E horizon has hue of 5YR to 10YR, value of 5 or 6, and chroma of 1 or 2. Pedons in cultivated areas have an Ap horizon with value of 3 or 4 and chroma of 2 or 3.

The Bhs horizon has value and chroma of 2 or 3. Some pedons have a Bs horizon. It has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. The B horizon is sandy loam or fine sandy loam. The E part of the E/Bx horizon has hue of 10R to 5YR, value of 4 to 6, and chroma of 2 to 4. It is fine sandy loam, sandy loam, or loamy sand. The Bt part has hue of 2.5YR or 5YR and value and chroma of 3 or 4. It is fine sandy loam, sandy loam, or sandy clay loam.

The C horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly sandy loam, but pockets or lenses of loamy sand are in some pedons.

Sturgeon Series

The Sturgeon series consists of very deep, somewhat poorly drained soils on flood plains. These soils formed in loamy and sandy alluvium. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slopes are 0 to 2 percent.

Typical pedon of Sturgeon silt loam, in an area of Sturgeon-Arnheim-Pelkie complex; 700 feet east and 350 feet north of the southwest corner of sec. 9, T. 53 N., R. 33 W.

Ap—0 to 8 inches; reddish brown (5YR 4/3) silt loam, light reddish brown (5YR 6/3) dry; moderate fine subangular blocky structure; friable; many roots; medium acid; abrupt smooth boundary.

C1—8 to 15 inches; reddish brown (5YR 4/3) very fine sandy loam; common fine distinct yellowish red (5YR 5/6) mottles; medium fine subangular blocky structure; friable; common roots; medium acid; abrupt smooth boundary.

C2—15 to 28 inches; reddish brown (5YR 4/3) silt loam; common fine distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; friable; common roots; medium acid; abrupt smooth boundary.

C3—28 to 34 inches; reddish brown (5YR 5/3) loamy very fine sand; common fine distinct yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; very friable; medium acid; clear wavy boundary.

2C4—34 to 60 inches; dark reddish gray (5YR 4/2) fine sand; single grained; loose; medium acid.

The thickness of the loamy material ranges from 16 to 36 inches. The Ap horizon has hue of 5YR or 7.5YR and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon. It has hue of 5YR or 7.5YR, value of 3, and chroma of 2 or 3.

The C horizons above a depth of 36 inches have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. They are silt loam, fine sandy loam, very fine sandy loam, and loamy very fine sand. The 2C4 horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is dominantly fine sand or sand. Thin layers of silty clay loam or sand are in the upper horizons in some pedons, and loamy material is below a depth of 40 to 50 inches in other pedons.

Tawas Series

The Tawas series consists of very deep, very poorly drained soils in depressions on outwash plains, lake plains, and moraines. These soils formed in organic deposits over sandy material. Permeability is moderately rapid to moderately slow in the organic material and rapid in the underlying material. Slopes are 0 to 1 percent.

Typical pedon of Tawas muck, in an area of Tawas-Roscommon mucks, 2,240 feet north and 1,280 feet east of the southwest corner of sec. 18, T. 55 N., R. 31 W.

Oa1—0 to 4 inches; muck, dark reddish brown (5YR 2/2) broken face, very dark gray (10YR 3/1) rubbed; about 40 percent fiber, 15 percent rubbed; weak fine and medium granular structure; nonsticky; many roots; woody and herbaceous fibers; strongly acid; abrupt smooth boundary.

Oa2—4 to 16 inches; muck, very dark gray (10YR 3/1) broken face and rubbed; about 30 percent fiber, 5 percent rubbed; massive; nonsticky; few roots; woody and herbaceous fibers; strongly acid; abrupt smooth boundary.

Oa3—16 to 20 inches; muck, black (10YR 2/1) broken face and rubbed; about 50 percent fiber, 10 percent rubbed; weak thick platy structure; nonsticky; mainly herbaceous fibers; strongly acid; abrupt smooth boundary.

2C—20 to 60 inches; brown (10YR 5/3) fine sand; single grained; loose; medium acid.

Depth to the sandy mineral horizon ranges from 16 to 50 inches. The organic material is primarily woody, but herbaceous layers are mixed throughout the organic layers in most pedons. The surface tier has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. The subsurface and bottom tiers have hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. Some pedons have a layer of mucky peat as much as 10 inches thick. The 2C horizon has value of 4 to 6 and chroma of 1 to 3. It is sand, loamy sand, or fine sand.

Trimountain Series

The Trimountain series consists of very deep, moderately well drained or well drained soils on ground moraines and end moraines. These soils formed in a loamy mantle over gravelly, loamy, and sandy glacial till. They have a fragipan. Permeability is moderate in the upper part of the profile, very slow in the fragipan, and moderate or moderately rapid in the lower part. Slopes range from 1 to 70 percent.

Typical pedon of Trimountain cobbly fine sandy loam, in an area of Trimountain-Paavola complex, dissected, 8 to 35 percent slopes; 1,850 feet west and 1,850 feet north of the southeast corner of sec. 24, T. 54 N., R. 35 W.

Oa—1 inch to 0; black (N 2/0), decomposed forest litter; many fine and medium roots; clear wavy boundary.

E—0 to 4 inches; dark reddish gray (5YR 4/2) cobbly fine sandy loam; weak fine subangular blocky structure; very friable; many roots; about 9 percent gravel and 11 percent cobbles; extremely acid; clear wavy boundary.

Bhs—4 to 10 inches; dark reddish brown (5YR 3/3) fine sandy loam; moderate medium subangular blocky structure; very friable; many roots; about 8 percent gravel and 2 percent cobbles; very strongly acid; clear wavy boundary.

Bs—10 to 26 inches; reddish brown (5YR 4/4) gravelly fine sandy loam; moderate medium subangular blocky structure; friable; common fine and medium and few coarse roots; about 18 percent gravel and 2 percent cobbles; very strongly acid; clear wavy boundary.

2E/Bx—26 to 33 inches; about 60 percent reddish brown (5YR 5/3) gravelly loamy sand (E); surrounding peds of reddish brown (2.5YR 4/4) gravelly fine sandy loam (Bt); weak thin platy structure; very firm; few roots; common fine vesicular pores; few faint reddish brown (5YR 4/4) clay films in pores and root channels; about 17 percent gravel and 6 percent cobbles; very strongly acid; clear wavy boundary.

2Btx—33 to 45 inches; reddish brown (5YR 4/4) gravelly loamy sand; massive; very firm; few very fine vesicular pores; few faint reddish brown (5YR 4/3) clay films in pores; about 30 percent gravel and 3 percent cobbles; very strongly acid; gradual wavy boundary.

2C1—45 to 55 inches; reddish brown (5YR 4/4) gravelly fine sand; massive; firm; about 17 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

3C2—55 to 80 inches; reddish brown (5YR 4/4) extremely gravelly coarse sand; massive; friable; about 65 percent gravel and 3 percent cobbles; strongly acid.

The thickness of the loamy mantle ranges from 15 to 32 inches. Depth to the fragipan ranges from 14 to 30 inches. The thickness of the solum ranges from 24 to 60 inches. The content of gravel ranges from 0 to 25 percent in the A, E, and B horizons, from 5 to 35 percent in the 2E/Bx and 2Btx horizons, and from 15 to 70 percent in the 2C horizon. The content of cobbles and stones ranges from 1 to 15 percent in the A, E, and B horizons and from 0 to 25 percent in the 2E/Bx, 2Btx, and 2C horizons.

The A horizon, if it occurs, has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2.

The Bhs horizon has hue of 5YR or 7.5YR and value

and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. The B horizon is fine sandy loam, very fine sandy loam, loamy fine sand, or the gravelly or cobbly analogs of those textures. The E part of the 2E/Bx horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. The B part has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6. The 2Btx horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The 2E/Bx and 2Btx horizons are fine sandy loam, sandy loam, loamy sand, loamy fine sand, or the gravelly analogs of those textures. The fragipan is very firm or extremely firm when moist. Faint to distinct mottles are in the upper part of the fragipan in many pedons as a result of impeded drainage.

The 2C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is fine sand, loamy fine sand, loamy very fine sand, or the gravelly or very gravelly analogs of those textures. The 3C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is gravelly coarse sand, gravelly sand, gravelly loamy sand, gravelly sandy loam, gravelly loamy fine sand, gravelly fine sandy loam, or the very gravelly or extremely gravelly analogs of those textures.

Vilas Series

The Vilas series consists of very deep, excessively drained soils on outwash plains and moraines. These soils formed in a loamy sand mantle over sandy glacial outwash. Permeability is rapid. Slopes range from 0 to 35 percent.

Typical pedon of Vilas loamy sand, in an area of Vilas-Rubicon complex, 10 to 35 percent slopes; 1,820 feet east and 1,480 feet south of the northwest corner of sec. 35, T. 47 N., R. 36 W.

Oe—1 inch to 0; black (N 2/0), partially decomposed forest litter; many roots; abrupt smooth boundary.

E—0 to 2 inches; brown (7.5YR 5/2) loamy sand; weak medium subangular blocky structure; very friable; common roots; about 3 percent gravel; strongly acid; clear wavy boundary.

Bs1—2 to 10 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; common roots; about 3 percent gravel; strongly acid; clear smooth boundary.

Bs2—10 to 19 inches; strong brown (7.5YR 4/6) loamy sand; weak medium subangular blocky structure; very friable; few roots; about 3 percent gravel; medium acid; clear smooth boundary.

BC—19 to 35 inches; strong brown (7.5YR 5/6) sand; weak medium subangular blocky structure; very friable; about 5 percent gravel; medium acid; clear smooth boundary.

C—35 to 60 inches; brown (7.5YR 5/4) sand; single grained; loose; about 5 percent gravel; medium acid.

The thickness of the solum ranges from 18 to 45 inches. The soil has 0 to 14 percent gravel.

The A horizon, if it occurs, has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. The E horizon has hue of 5YR to 10YR, value of 3 to 6, and chroma of 1 or 2. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 4 to 6. The C horizon has hue of 5YR to 10YR and value and chroma of 4 to 6.

Waiska Series

The Waiska series consists of very deep, excessively drained, very rapidly permeable soils on outwash plains and stream terraces. These soils formed in gravelly and sandy deposits. Slopes range from 0 to 70 percent.

Typical pedon of Waiska sand, in an area of Kalkaska-Waiska complex, 15 to 35 percent slopes; 130 feet south and 66 feet east of the northwest corner of sec. 25, T. 54 N., R. 34 W.

Oe—1 inch to 0; black (N 2/0), partially decomposed leaf litter; many roots; abrupt smooth boundary.

E—0 to 6 inches; brown (7.5YR 5/2) sand; weak medium subangular blocky structure; very friable; many roots; about 8 percent gravel; strongly acid; clear irregular boundary.

Bhs—6 to 11 inches; dark reddish brown (5YR 3/3) gravelly sand; weak medium subangular blocky structure; very friable; many roots; about 17 percent gravel; strongly acid; clear irregular boundary.

Bs—11 to 35 inches; dark brown (7.5YR 4/4) very gravelly sand; weak medium subangular blocky structure; very friable; common roots; about 35 percent gravel and 15 percent cobbles; medium acid; clear wavy boundary.

C1—35 to 49 inches; yellowish brown (10YR 5/4) extremely gravelly coarse sand; single grained; loose; about 75 percent gravel and 5 percent cobbles; medium acid; clear smooth boundary.

C2—49 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grained; loose; about 15 percent gravel and 2 percent cobbles; medium acid.

The thickness of the solum ranges from 30 to 50 inches. Gravel and cobbles make up 5 to 25 percent of

the upper part of the solum and 35 to 75 percent of the lower part. The content of cobbles is less than 10 percent.

Some pedons have an A horizon. It has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 1 or 2.

The Bhs horizon has value and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. The B horizon is gravelly loamy sand, gravelly loamy coarse sand, gravelly coarse sand, gravelly sand, or the very gravelly analogs of those textures. The C horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 or 4.

Watton Series

The Watton series consists of very deep, well drained, moderately slowly permeable soils on till plains and moraines. These soils formed in loamy glacial till. Slopes range from 1 to 8 percent.

Typical pedon of Watton loam, 1 to 8 percent slopes, 1,222 feet south and 1,509 feet west of the northeast corner of sec. 17, T. 47 N., R. 33 W.

Ap—0 to 7 inches; reddish brown (5YR 4/3) loam, light reddish brown (5YR 6/3) dry; moderate medium granular structure; friable; many fine roots; about 5 percent gravel; medium acid; abrupt smooth boundary.

B/E—7 to 11 inches; about 80 percent reddish brown (5YR 4/4) clay loam (B); surrounded by thin coatings of reddish brown (5YR 5/3) loam (E); moderate medium and coarse subangular blocky structure; firm; common roots; about 5 percent gravel; medium acid; clear wavy boundary.

Bt—11 to 24 inches; reddish brown (5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few roots; thick continuous reddish brown (2.5YR 5/4) clay films on faces of peds; about 5 percent gravel; medium acid; gradual wavy boundary.

BC—24 to 36 inches; reddish brown (2.5YR 4/4) clay loam; weak thin platy structure; firm; about 5 percent gravel; medium acid; gradual wavy boundary.

C—36 to 60 inches; reddish brown (2.5YR 4/4) clay loam; weak thin platy structure; firm; about 5 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 60 inches. The soil has 1 to 5 percent gravel and 0 to 5 percent cobbles.

The Ap horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 or 3. Some pedons have an A horizon. It has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2.

The E part of the B/E horizon has hue of 2.5YR to 7.5YR, value of 5 or 6, and chroma of 2 or 3. It is silt loam or loam. The B part of the B/E horizon and the Bt horizon have hue of 2.5YR or 5YR and chroma of 3 or 4. They are clay loam, loam, silt loam, or silty clay loam.

The C horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam, loam, silt loam, or silty clay loam.

Witbeck Series

The Witbeck series consists of very deep, poorly drained, moderately permeable or moderately slowly permeable soils on till plains. These soils formed in loamy glacial till. Slopes are 0 to 2 percent.

Typical pedon of Witbeck very stony muck, 0 to 2 percent slopes, 2,400 feet east and 300 feet south of the northwest corner of sec. 11, T. 55 N., R. 33 W.

Oa—0 to 6 inches; black (N 2/0) very stony muck; moderate fine granular structure; friable; many roots; about 45 percent stones; medium acid; clear wavy boundary.

A—6 to 10 inches; dark brown (7.5YR 3/2) very stony silt loam, brown (7.5YR 4/2) dry; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium granular structure; friable; common roots; about 45 percent stones; medium acid; abrupt wavy boundary.

Bg—10 to 18 inches; brown (7.5YR 4/2) sandy loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; about 8 percent gravel and 2 percent cobbles; medium acid; clear wavy boundary.

Bw—18 to 24 inches; brown (7.5YR 4/4) gravelly sandy loam; many medium distinct brown (7.5YR 5/2) and many medium distinct reddish yellow (7.5YR 6/6) mottles; weak medium subangular blocky structure; friable; about 20 percent gravel and 5 percent cobbles; slightly acid; clear wavy boundary.

C—24 to 60 inches; brown (7.5YR 4/4) gravelly loamy sand; massive; very friable; about 25 percent gravel and 5 percent cobbles; slightly acid.

The thickness of the solum ranges from 18 to 24 inches. The content of gravel ranges from 0 to 10 percent in the surface horizons and from 5 to 35

percent in the B and C horizons. The content of stones and cobbles ranges from 35 to 60 percent in the surface horizons and from 0 to 15 percent in the B and C horizons.

The O horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. The A horizon has hue of 5YR to 2.5Y, value of 2 to 4, and chroma of 1 or 2. It is very stony silt loam or very stony mucky silt loam.

The B and C horizons have hue of 7.5YR to 5Y, value of 3 to 5, and chroma of 1 to 4. The B horizon is sandy loam, fine sandy loam, or the gravelly analogs of those textures. The C horizon is loamy fine sand, loamy sand, sandy loam, fine sandy loam, or the gravelly analogs of those textures.

Yalmer Series

The Yalmer series consists of very deep, moderately well drained or well drained soils on till plains and moraines. These soils formed in a sandy mantle over loamy glacial till. They have a fragipan. Permeability is rapid in the upper part of the profile, very slow in the fragipan, and moderate in the lower part. Slopes range from 1 to 60 percent.

Typical pedon of Yalmer sand, in an area of Munising-Yalmer complex, 1 to 8 percent slopes; 2,310 feet north and 2,508 feet west of the southeast corner of sec. 12, T. 53 N., R. 33 W.

Oa—2 inches to 0; black (N 2/0), well decomposed forest litter; many roots; abrupt smooth boundary.

E—0 to 9 inches; pinkish gray (5YR 6/2) sand; weak fine subangular blocky structure; very friable; common roots; about 2 percent gravel; medium acid; clear wavy boundary.

Bhs—9 to 11 inches; dark reddish brown (5YR 3/2) sand; weak medium subangular blocky structure; very friable; common roots; about 2 percent gravel; strongly acid; clear wavy boundary.

Bs1—11 to 14 inches; reddish brown (5YR 4/4) sand; weak fine subangular blocky structure; very friable; few roots; about 2 percent gravel; medium acid; gradual wavy boundary.

Bs2—14 to 20 inches; yellowish red (5YR 4/6) sand; weak fine subangular blocky structure; very friable; few roots; about 5 percent gravel; medium acid; abrupt smooth boundary.

2E/Bx—20 to 25 inches; about 60 percent light reddish brown (5YR 6/3) loamy sand (E); surrounding peds of reddish brown (2.5YR 4/4) loamy sand (Bt); weak thin platy structure; very firm; few roots; about 5 percent gravel; medium acid; clear smooth boundary.

2B/Ex—25 to 38 inches; about 60 percent reddish brown (2.5YR 4/4) fine sandy loam (Bt); surrounded by light reddish brown (5YR 6/3) loamy sand (E); common fine distinct yellowish red (2.5YR 5/6) mottles; weak thin platy structure; very firm; about 5 percent gravel; medium acid; clear wavy boundary.

2Bt—38 to 47 inches; reddish brown (2.5YR 4/4) fine sandy loam; weak medium subangular blocky structure; firm; about 5 percent gravel; medium acid; clear smooth boundary.

2C—47 to 60 inches; reddish brown (2.5YR 4/4) fine sandy loam; massive; friable; about 5 percent gravel; slightly acid.

Depth to the fragipan ranges from 20 to 40 inches. The thickness of the solum ranges from 36 to 70 inches. The soil has 0 to 15 percent gravel.

The E horizon has hue of 5YR to 10YR and value of 5 to 7. The Bhs horizon has value and chroma of 2 or 3. The Bs1 horizon has hue of 2.5YR to 7.5YR, value of 3 or 4, and chroma of 4 to 6. The Bs2 horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The B horizon is sand, fine sand, or loamy sand. The E part of the 2E/Bx and 2B/Ex horizons has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 2 to 4. It is loamy sand, loamy fine sand, sandy loam, or fine sandy loam. The B part has hue of 10R to 5YR, value of 3 to 5, and chroma of 3 or 4. It is fine sandy loam or sandy loam.

The 2C horizon has hue of 10R to 5YR, value of 4 or 5, and chroma of 3 or 4. It is fine sandy loam or sandy loam. Sand lenses are below a depth of 50 inches in some pedons.

Zeba Series

The Zeba series consists of moderately deep, somewhat poorly drained, moderately permeable soils on till plains and sandstone benches. These soils formed in loamy glacial drift over sandstone bedrock. Slopes range from 0 to 3 percent.

Typical pedon of Zeba fine sandy loam, in an area of Zeba-Jacobsville complex, 0 to 3 percent slopes; 1,400 feet east and 1,700 feet north of the southwest corner of sec. 4, T. 53 N., R. 32 W.

Oa—3 inches to 0; black (5YR 2/1), well decomposed forest litter; many roots; about 5 percent gravel; abrupt smooth boundary.

E—0 to 5 inches; gray (5YR 6/1) fine sandy loam; few fine faint gray (5YR 5/1) mottles; weak thin platy structure; friable; many roots; about 5 percent gravel; very strongly acid; clear wavy boundary.

Bs—5 to 12 inches; reddish brown (5YR 4/4) fine sandy loam; common medium distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; friable; common roots; about 5 percent gravel; strongly acid; clear wavy boundary.

E/B—12 to 26 inches; about 60 percent reddish brown (5YR 5/3) fine sandy loam (E); common medium distinct yellowish red (5YR 5/6) mottles; surrounding peds of reddish brown (2.5YR 4/4) fine sandy loam (Bt); weak fine subangular blocky structure; firm; few faint clay films on faces of peds; about 8 percent gravel; medium acid; clear wavy boundary.

Bt—26 to 35 inches; reddish brown (2.5YR 4/4) fine sandy loam; common medium prominent yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; firm; common faint clay films on faces of peds; about 8 percent gravel; slightly acid; abrupt smooth boundary.

2R—35 inches; sandstone bedrock.

The depth to bedrock and the thickness of the solum range from 20 to 40 inches. The soil has 0 to 15 percent gravel and 0 to 10 percent cobbles.

The A or Ap horizon, if it occurs, has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. The E horizon has hue of 5YR to 10YR, value of 5 or 6, and chroma of 1 to 3.

The Bs horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is sandy loam or fine sandy loam. The E part of the 2E/B horizon has chroma of 2 to 4. It is fine sandy loam, sandy loam, or loamy sand. The B part of the 2E/B horizon and the 2Bt horizon are fine sandy loam or sandy loam.

Some pedons have a C horizon. This horizon has hue of 2.5YR or 5YR and value and chroma of 4. It is sandy loam.

Formation of the Soils

This section relates the five major factors of soil formation to the soils in the survey area. It also explains the processes of soil formation.

Factors of Soil Formation

Soil forms through the interaction of five major factors—the physical, chemical, and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material *(7)*.

Climate and plant and animal life are the active forces of soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It affects the limits of the chemical and mineralogical composition of the soil. In this survey area, nearly all of the parent materials were deposited by glaciers or glacial meltwater. The subsequent actions of water and wind reworked and redeposited the materials. Although most of the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited.

The dominant parent materials in the survey area were deposited as glacial till, glacial drift, outwash, lacustrine material, alluvium, and organic material. The soil mantle ranges from several inches to more than 360 feet in thickness. Bedrock commonly is exposed or at a shallow depth throughout the survey area.

Glacial till was deposited directly by glaciers with minimal water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. Graveraet and Munising are examples of soils that formed in glacial till on till plains and moraines.

Glacial drift is pulverized rock material transported and deposited by glacial ice. It also is the sorted and unsorted material that was deposited by streams flowing from the glaciers. Allouez and Paavola are examples of soils that formed in glacial drift.

Outwash material was deposited by running water from melting glaciers. The size of the particles depends on the speed of the stream that carried the material. The water deposited the coarser particles as it slowed down. Slowly moving water carried the finer particles, such as very fine sand, silt, and clay. Outwash deposits generally occur as layers of particles of similar size, such as sand, gravel, or other coarse particles. Vilas and Waiska are examples of soils that formed in deposits of outwash material.

Lacustrine material was deposited from still, or ponded, glacial meltwater. It consists of fine soil particles, such as very fine sand, silt, and clay, that settled out in the still water. In this survey area, the soils that formed in lacustrine deposits are typically medium textured to fine textured. Ontonagon soils are an example of soils that formed in lacustrine material.

Alluvium is material recently deposited by floodwater from streams. This material varies in texture, depending on the speed of the water from which it was deposited. Sturgeon soils are an example of soils that formed in alluvium.

Organic material occurs as deposits of plant residue. After the glaciers withdrew from the area, water remained standing in depressions on outwash plains,

flood plains, moraines, and till plains. Grasses and sedges grew around the edges of these lakes. When these plants died, their residue did not decompose because the areas were wet. Later, water-tolerant trees grew in the areas. After these trees died, their residue became part of the organic accumulation. Eventually, the lakes were filled with organic material and developed into areas of muck. Lupton soils are an example of soils that formed in organic material.

Plant and Animal Life

Plants, animals, insects, bacteria, and fungi are important in the formation of soils. Additions of organic matter and nitrogen in the soil, gains or losses in plant nutrients, and alterations in soil structure and porosity are among the changes caused by living organisms. In this survey area, vegetation, dominantly hardwood and coniferous trees, has affected soil formation more than the other living organisms.

Climate

Climate determines the kind of plant and animal life on and in the soil and the amount of water available for the weathering of minerals and the translocation of soil material. Through its influence on soil temperature, climate also determines the rate of chemical reaction in the soil.

The climate in Houghton County is cool and humid. Presumably, it is similar to that under which the soils formed. The soils in Houghton County differ from soils that formed under a dry, warm climate and from those that formed under a moist, hot climate. The climate generally is uniform in all areas, except for those within a few miles of Lake Superior. Only minor differences among the soils in the county are the result of differences in climate.

Relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. The topography in Houghton County varies greatly. It includes both depressions and steep hills. In the hilly areas, local relief is as much as 400 to 600 feet and the slope is as much as 70 percent. In some areas along the Sturgeon River, the slope is less than 2 percent. Many small nearly level areas are interspersed throughout the undulating and hilly areas. The nearly level areas receive runoff from the more sloping areas. The water table is at or near the surface in depressional areas.

Through its effect on soil aeration, drainage determines the color of the soil. Water and air move freely through well drained soils and slowly through very poorly drained soils. In well aerated soils, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized. Poorly aerated soils are dull gray and mottled. The sequence of somewhat excessively drained Kalkaska, moderately well drained Halfaday, somewhat poorly drained Au Gres, and poorly drained Roscommon soils is an example of a catena. All of these soils formed in sandy material, but they have different colors because of variations in relief and drainage.

Time

Generally, a long time is needed for the development of distinct horizons. The degree of profile development commonly reflects the length of time that the parent material has been in place. Some soils form rapidly. Others form slowly.

The soils in Houghton County range from young to mature. Most of the soils that formed in glacial deposits have been exposed to the soil-forming factors long enough for the development of distinct horizons. Yalmer soils are an example. The soils that formed in recent alluvial material have not been in place long enough for distinct horizons to develop. Pelkie soils are an example.

Processes of Soil Formation

The processes responsible for the development of the soil horizons in the unconsolidated parent material are referred to as soil genesis. Several processes were involved in the development of horizons in the soils of Houghton County. These are the accumulation of organic matter, the leaching of lime (calcium carbonate) and other bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. More than one of these processes have helped to differentiate horizons in most of the soils.

As organic matter accumulates at the surface, an A horizon forms. The A and E horizons are mixed into a plow layer, or Ap horizon, if the soil is plowed. The surface layer of the soils in Houghton County ranges from high to low in organic matter content. The content is high, for example, in Gay soils and low in Rubicon soils.

Carbonates and other bases have been leached from most of the soils. The leaching of bases generally precedes the translocation of silicate clay minerals.

Many of the soils are moderately leached or strongly leached. Watton soils, for example, are leached of carbonates to a depth of about 40 inches.

Gleying, or the reduction and transfer of iron, is evident in somewhat poorly drained, poorly drained, and very poorly drained soils. An example is Bergland soils. A gray color in the subsoil indicates the reduction and loss of iron. Some horizons have mottles, indicating the segregation of iron. This process has taken place in Rudyard soils.

The translocation of clay minerals has contributed to horizon development in some soils. An eluviated, or leached, E horizon typically is lower in content of clay and lighter in color than the illuviated B horizon. The B horizon typically has an accumulation of clay, or clay films, in pores and on the faces of peds. These soils were probably leached of carbonates and soluble salts to a considerable extent before the translocation of silicate clay minerals. Nunica soils are an example of soils in which translocated silicate clay minerals in the form of clay films have accumulated in the B horizon.

In some of the soils in Houghton County, iron, aluminum, and humus have been transferred from the surface layer to the B horizon. Kalkaska and Yalmer soils are examples.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons.

Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Fine textured soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers

especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when

thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat. Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from

about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 incnes
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the

swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes as defined in this manuscript are as follows:

Nearly level	0 to 3 percent
Undulating	2 to 8 percent
Gently rolling	8 to 12 percent
Rolling	12 to 15 percent
Hilly	15 to 25 percent
Steep	25 to 35 percent
Very steep	35 to 70 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
Recorded in the period 1951-80 at Houghton/Calumet											
January	19.8	7.0	13.4	39	-18	0	3.70	2.5	4.8	12	61.2
February	22.1	6.7	14.4	44	-17	0	2.06	1.2	2.8	7	32.8
March	30.9	15.2	23.1	55	-12	0	2.22	1.0	3.3	6	23.1
April	45.0	29.1	37.1	74	10	14	1.88	1.3	2.4	5	8.0
May	59.5	39.2	49.4	87	24	112	3.07	1.7	4.2	7	2.5
June	69.5	48.3	58.9	90	33	285	3.03	2.0	4.0	7	.0
July	74.9	54.4	64.7	93	40	463	2.90	1.6	4.0	6	.0
August	72.5	53.6	63.0	92	40	412	3.37	1.7	4.9	6	.0
September	62.8	45.8	54.3	87	28	178	3.49	2.1	4.7	8	.0
October	52.4	37.5	45.0	80	20	54	2.38	1.3	3.3	6	4.6
November	36.7	25.6	31.1	62	5	1	2.95	1.9	3.9	8	25.2
December	25.3	13.8	19.6	45	-8	0	3.08	1.8	4.2	11	50.4
Year	47.6	31.3	39.5	---	---	1,519	34.13	---	---	89	207.8
Recorded in the period 1951-80 at Kenton											
January	22.0	.8	11.4	44	-36	0	1.11	.7	1.5	4	24.3
February	27.2	1.0	14.1	52	-36	0	.93	.4	1.4	3	15.8
March	38.1	11.2	24.6	61	-29	1	1.46	.6	2.2	4	14.7
April	52.9	26.3	39.6	82	-2	31	2.16	1.3	2.9	5	6.3
May	66.8	37.5	52.1	89	15	165	3.44	2.2	4.6	7	.9
June	75.4	46.6	61.0	92	25	344	3.94	2.4	5.4	8	.0
July	79.8	51.1	65.4	94	31	487	3.70	2.0	5.2	7	.0
August	77.2	49.6	63.4	94	29	425	3.87	2.4	5.2	7	.0
September	67.7	42.9	55.3	89	21	207	3.60	2.1	5.0	7	.0
October	57.3	34.3	45.8	81	17	71	2.60	1.4	3.7	6	2.7
November	39.9	22.1	31.0	67	-8	3	2.17	1.4	2.9	7	17.0
December	26.9	8.4	17.6	49	-24	0	1.33	.8	1.8	4	22.9
Year	52.6	27.7	40.1	---	---	1,734	30.31	---	---	69	104.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature		
	24^{o} F or lower	28^{o} F or lower	32^{o} F or lower
Recorded in the period 1930-79 at Houghton/Calumet			
Last freezing temperature in spring:			
1 year in 10 later than--	May 5	May 18	June 6
2 years in 10 later than--	May 1	May 14	May 31
5 years in 10 later than--	Apr. 23	May 7	May 21
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 16	Sept. 25	Sept. 14
2 years in 10 earlier than--	Oct. 21	Oct. 2	Sept. 20
5 years in 10 earlier than--	Nov. 1	Oct. 15	Oct. 1
Recorded in the period 1941-80 at Kenton			
Last freezing temperature in spring:			
1 year in 10 later than--	June 1	June 14	July 7
2 years in 10 later than--	May 26	June 8	July 1
5 years in 10 later than--	May 16	May 29	June 14
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 13	Aug. 28	Aug. 9
2 years in 10 earlier than--	Sept. 19	Sept. 3	Aug. 15
5 years in 10 earlier than--	Oct. 1	Sept. 14	Aug. 28

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature		
	Higher than 24^{o} F	Higher than 28^{o} F	Higher than 32^{o} F
	Days	Days	Days
Recorded in the period 1930-79 at Houghton/Calumet			
9 years in 10	164	127	102
8 years in 10	177	143	117
5 years in 10	191	160	132
2 years in 10	205	177	147
1 year in 10	212	186	155
Recorded in the period 1941-80 at Kenton			
9 years in 10	109	83	45
8 years in 10	118	91	53
5 years in 10	137	107	69
2 years in 10	155	123	84
1 year in 10	165	131	92

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
10B	Munising loamy fine sand, 1 to 8 percent slopes	19,357	4.0
10D	Munising loamy fine sand, 8 to 15 percent slopes	1,556	0.3
10E	Munising loamy fine sand, 15 to 35 percent slopes	861	0.2
11A	Skanee fine sandy loam, 0 to 3 percent slopes	1,731	0.3
12	Gay muck	3,421	0.7
14A	Assinins sand, 0 to 3 percent slopes	1,534	0.3
15B	Kalkaska sand, 0 to 8 percent slopes	8,814	1.8
15D	Kalkaska sand, 8 to 15 percent slopes	1,223	0.2
15E	Kalkaska sand, 15 to 35 percent slopes	787	0.2
16B	Rubicon sand, 0 to 8 percent slopes	2,478	0.5
16D	Rubicon sand, 8 to 15 percent slopes	321	0.1
17A	Croswell sand, 0 to 3 percent slopes	1,345	0.3
18A	Au Gres sand, 0 to 3 percent slopes	2,191	0.4
21B	Keweenaw-Kalkaska complex, 1 to 8 percent slopes	5,531	1.1
21D	Keweenaw-Kalkaska complex, 8 to 15 percent slopes	696	0.1
22B	Abbaye-Munising loamy fine sands, 1 to 8 percent slopes	4,196	0.8
23A	Zeba-Jacobsville complex, 0 to 3 percent slopes	1,228	0.2
24B	Deerton sand, 1 to 8 percent slopes	1,177	0.2
25	Lupton and Cathro mucks	13,700	2.8
26	Dawson and Loxley peats	3,826	0.8
27	Histosols and Aquents, ponded	7,960	1.6
29B	Waiska sand, 0 to 8 percent slopes	2,118	0.4
30B	Munising-Skanee complex, 0 to 8 percent slopes	24,538	5.0
31A	Skanee-Gay complex, 0 to 3 percent slopes	11,862	2.4
32B	Alcona loamy fine sand, 1 to 8 percent slopes	1,007	0.2
33B	Munising-Yalmer complex, 1 to 8 percent slopes	14,323	2.9
33D	Munising-Yalmer complex, 8 to 15 percent slopes	2,110	0.4
34B	Munising loamy fine sand, dissected, 1 to 12 percent slopes	18,922	3.9
34D	Munising loamy fine sand, dissected, 8 to 35 percent slopes	2,700	0.5
34E	Munising loamy fine sand, dissected, 15 to 60 percent slopes	2,457	0.5
35B	Graveraet loam, 1 to 8 percent slopes	8,699	1.7
35D	Graveraet loam, 8 to 15 percent slopes	1,081	0.2
35E	Graveraet loam, 15 to 35 percent slopes	497	0.1
36A	Sturgeon silt loam	1,082	0.2
37	Arnheim silt loam	2,029	0.4
38A	Pelkie loamy fine sand, 0 to 3 percent slopes	425	0.1
41A	Misery very fine sandy loam, 0 to 3 percent slopes	2,198	0.4
45	Pits, borrow	286	0.1
46B	Karlin-Kalkaska complex, 0 to 8 percent slopes	1,064	0.2
46D	Karlin-Kalkaska complex, 8 to 15 percent slopes	392	0.1
47B	Ocqueoc-Halfaday complex, 0 to 8 percent slopes	1,554	0.3
51A	Allendale-Rudyard complex, 0 to 3 percent slopes	2,208	0.4
52B	Allouez gravelly silt loam, 1 to 8 percent slopes	710	0.1
55	Dumps, mine	492	0.1
56	Jacobsville muck	355	0.1
58B	Manistee-Ontonagon complex, dissected, 1 to 12 percent slopes	1,321	0.3
59B	Graveraet-Ocqueoc-Kalkaska complex, 1 to 8 percent slopes	5,144	1.0
60B	Nunica-Fence complex, dissected, 1 to 12 percent slopes	1,128	0.2
60D	Nunica-Fence complex, dissected, 8 to 35 percent slopes	832	0.2
60E	Nunica-Fence complex, dissected, 15 to 60 percent slopes	305	0.1
61B	Ontonagon silt loam, 1 to 6 percent slopes	1,180	0.2
61D	Ontonagon silt loam, 6 to 15 percent slopes	185	*
61E	Ontonagon silt loam, 15 to 35 percent slopes	203	*
65A	Rudyard silt loam, 0 to 3 percent slopes	1,511	0.3
66B	Munising-Abbaye-Kalkaska complex, dissected, 1 to 12 percent slopes, rocky	5,530	1.1
66D	Munising-Abbaye-Kalkaska complex, dissected, 8 to 35 percent slopes, rocky	2,023	0.4
66F	Munising-Abbaye-Kalkaska complex, dissected, 15 to 70 percent slopes, rocky	4,852	1.0
67	Roscommon muck	1,714	0.3
68	Dumps, stamp sand	1,608	0.3
69B	Watton-Alstad loams, 0 to 8 percent slopes	889	0.2
70B	Watton loam, 1 to 8 percent slopes	565	0.1
71A	Richter very fine sandy loam, 0 to 3 percent slopes	418	0.1
72A	Halfaday sand, 0 to 3 percent slopes	2,844	0.6

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
73B	Froberg-Rudyard silt loams, 1 to 8 percent slopes	5,893	1.2
75A	Croswell-Au Gres sands, 0 to 3 percent slopes	3,844	0.8
76A	Au Gres-Kinross complex, 0 to 3 percent slopes	1,472	0.3
77	Tawas-Roscommon mucks	9,044	1.8
78B	Deer Park sand, 0 to 8 percent slopes	832	0.2
79B	Yalmer-Assinins sands, 0 to 8 percent slopes	5,435	1.1
83	Udipsamments and Udorthents, nearly level	2,752	0.6
84B	Graveraet loam, dissected, 1 to 12 percent slopes	7,663	1.5
84D	Graveraet loam, dissected, 8 to 35 percent slopes	2,186	0.4
84E	Graveraet loam, dissected, 15 to 60 percent slopes	3,880	0.8
86B	Trimountain cobbly fine sandy loam, 1 to 8 percent slopes	5,690	1.1
86D	Trimountain cobbly fine sandy loam, 8 to 15 percent slopes	1,893	0.4
86E	Trimountain cobbly fine sandy loam, 15 to 35 percent slopes	985	0.2
89B	Trimountain-Paavola complex, 1 to 8 percent slopes	6,980	1.4
89D	Trimountain-Paavola complex, 8 to 15 percent slopes	835	0.2
89E	Trimountain-Paavola complex, 15 to 35 percent slopes	507	0.1
90	Witbeck very stony muck	1,730	0.3
92B	Arcadian-Michigamme-Rock outcrop complex, 1 to 8 percent slopes	1,208	0.2
92D	Arcadian-Michigamme-Rock outcrop complex, 8 to 15 percent slopes	448	0.1
92E	Arcadian-Michigamme-Rock outcrop complex, 15 to 35 percent slopes	537	0.1
95A	Assinins-Skanee complex, 0 to 3 percent slopes	3,125	0.6
96B	Liminga fine sand, 0 to 8 percent slopes	11,474	2.3
96D	Liminga fine sand, 8 to 15 percent slopes	3,142	0.6
96E	Liminga fine sand, 15 to 35 percent slopes	1,662	0.3
96F	Liminga fine sand, 35 to 70 percent slopes	1,174	0.2
98B	Munising-Yalmer complex, dissected, 1 to 12 percent slopes	15,606	3.2
98D	Munising-Yalmer complex, dissected, 8 to 35 percent slopes	6,684	1.3
98E	Munising-Yalmer complex, dissected, 15 to 60 percent slopes	6,292	1.3
100A	Au Gres-Roscommon complex, 0 to 3 percent slopes	7,083	1.4
101A	Net stony fine sandy loam, 0 to 3 percent slopes	1,031	0.2
102A	Net-Witbeck complex, 0 to 3 percent slopes	5,546	1.1
103B	Trimountain-Net complex, 0 to 8 percent slopes	7,820	1.6
104D	Urban land-Udorthents complex, strongly sloping, rocky	280	0.1
106B	Urban land-Udorthents-Udipsamments complex, gently sloping	2,555	0.5
106D	Urban land-Udorthents-Udipsamments complex, strongly sloping	397	0.1
106E	Urban land-Udorthents-Udipsamments complex, steep	207	*
107B	Kalkaska-Waiska sands, 0 to 8 percent slopes	8,238	1.7
107D	Kalkaska-Waiska sands, 8 to 15 percent slopes	1,862	0.4
107E	Kalkaska-Waiska sands, 15 to 35 percent slopes	3,046	0.6
108B	Freda silt loam, 1 to 8 percent slopes	793	0.2
110D	Kalkaska-Waiska sands, dissected, 8 to 35 percent slopes	404	0.1
110E	Kalkaska-Waiska sands, dissected, 15 to 60 percent slopes	685	0.1
115B	Trimountain-Paavola complex, dissected, 1 to 12 percent slopes	4,070	0.8
115D	Trimountain-Paavola complex, dissected, 8 to 35 percent slopes	2,940	0.6
115E	Trimountain-Paavola complex, dissected, 15 to 60 percent slopes	2,893	0.6
116B	Trimountain-Paavola-Michigamme complex, dissected, 1 to 12 percent slopes, rocky	4,314	0.9
116D	Trimountain-Paavola-Michigamme complex, dissected, 8 to 35 percent slopes, rocky	1,216	0.2
116E	Trimountain-Paavola-Michigamme complex, dissected, 15 to 60 percent slopes, rocky	916	0.2
119A	Net-Witbeck complex, 0 to 3 percent slopes, rocky	1,128	0.2
125	Kinross-Dawson complex	1,257	0.3
127B	Keweenaw-Kalkaska complex, dissected, 1 to 12 percent slopes	1,308	0.3
127D	Keweenaw-Kalkaska complex, dissected, 8 to 35 percent slopes	682	0.1
127E	Keweenaw-Kalkaska complex, dissected, 15 to 60 percent slopes	925	0.2
130B	Munising-Alcona-Liminga complex, dissected, 1 to 12 percent slopes	1,242	0.2
130D	Munising-Alcona-Liminga complex, dissected, 8 to 35 percent slopes	2,288	0.5
130F	Munising-Alcona-Liminga complex, dissected, 15 to 70 percent slopes	10,743	2.2
131B	Graveraet-Misery complex, 0 to 8 percent slopes	9,574	1.9
132B	Kalkaska-Alcona complex, dissected, 1 to 12 percent slopes	2,802	0.6
132D	Kalkaska-Alcona complex, dissected, 8 to 35 percent slopes	2,479	0.5
132F	Kalkaska-Alcona complex, dissected, 15 to 70 percent slopes	6,728	1.4
133B	Liminga-Alcona complex, 0 to 8 percent slopes	1,359	0.3
133D	Liminga-Alcona complex, 8 to 15 percent slopes	508	0.1
133E	Liminga-Alcona complex, 15 to 35 percent slopes	554	0.1

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
134A	Halfaday-Au Gres sands, 0 to 3 percent slopes	5,082	1.0
135D	Deer Park-Kinross complex, 0 to 15 percent slopes	210	*
136B	Michigamme-Net complex, 0 to 8 percent slopes, rocky	724	0.1
137A	Sturgeon-Arnheim-Pelkie complex	7,258	1.5
138	Bergland muck	400	0.1
139B	Trimountain-Paavola-Waiska complex, 1 to 8 percent slopes	9,263	1.9
139D	Trimountain-Paavola-Waiska complex, 8 to 15 percent slopes	1,377	0.3
139E	Trimountain-Paavola-Waiska complex, 15 to 35 percent slopes	393	0.1
140B	Trimountain-Paavola-Waiska complex, dissected, 1 to 12 percent slopes	2,890	0.6
140D	Trimountain-Paavola-Waiska complex, dissected, 8 to 35 percent slopes	476	0.1
140E	Trimountain-Paavola-Waiska complex, dissected, 15 to 60 percent slopes	715	0.1
142F	Keweenaw-Kalkaska-Waiska complex, dissected, 15 to 70 percent slopes	816	0.2
144F	Graveraet-Kalkaska complex, dissected, 15 to 70 percent slopes	10,913	2.2
145B	Kalkaska-Halfaday sands, 0 to 8 percent slopes	1,688	0.3
146	Cathro-Gay mucks	2,682	0.5
147B	Munising-Liminga-Alcona complex, 1 to 8 percent slopes	3,986	0.8
148B	Graveraet-Ocqueoc-Kalkaska complex, dissected, 1 to 12 percent slopes	5,882	1.2
148D	Graveraet-Ocqueoc-Kalkaska complex, dissected, 8 to 35 percent slopes	2,171	0.4
150B	Richter-Alcona complex, 0 to 8 percent slopes	735	0.1
151B	Champion cobbly very fine sandy loam, 1 to 8 percent slopes	734	0.1
152B	Kallio cobbly very fine sandy loam, 1 to 8 percent slopes	909	0.2
153B	Champion-Karlin-Fence complex, 1 to 8 percent slopes	1,731	0.3
153D	Champion-Karlin-Fence complex, 8 to 15 percent slopes	965	0.2
153E	Champion-Karlin-Fence complex, 15 to 35 percent slopes	460	0.1
154B	Vilas-Rubicon complex, 0 to 6 percent slopes	890	0.2
154E	Vilas-Rubicon complex, 10 to 35 percent slopes	999	0.2
	Water areas less than 40 acres in size	1,463	0.3
	Total	497,952	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
32B	Alcona loamy fine sand, 1 to 8 percent slopes
36A	Sturgeon silt loam (where drained)
69B	Watton-Alstad loams, 0 to 8 percent slopes
70B	Watton loam, 1 to 8 percent slopes
71A	Richter very fine sandy loam, 0 to 3 percent slopes (where drained)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Oats	Irish potatoes	Corn silage	Straw-berries	Alfalfa hay	Bromegrass-alfalfa hay	Pasture
		Bu	Cwt	Tons	Crates	Tons	Tons	AUM*
10B------------- Munising	IIe	70	350	---	400	---	3.0	1.3
10D------------- Munising	IIIe	65	---	---	---	---	2.5	1.1
10E------------- Munising	VIIe	---	---	---	---	---	---	---
11A------------- Skanee	IIw	75	---	---	---	3.0	---	---
12-------------- Gay	Vw	---	---	---	---	---	---	---
14A------------- Assinins	IIIw	65	---	---	---	---	3.0	---
15B------------- Kalkaska	IVs	---	---	---	---	---	---	---
15D------------- Kalkaska	VIs	---	---	---	---	---	---	---
15E------------- Kalkaska	VIIs	---	---	---	---	---	---	---
16B, 16D-------- Rubicon	VIs	---	---	---	---	2.0	---	---
17A------------- Croswell	IVs	---	---	---	---	2.5	---	---
18A------------- Au Gres	IVw	---	---	---	---	---	1.8	---
21B------------- Keweenaw-Kalkaska	IIIe	51	251	10	---	2.8	1.9	---
21D------------- Keweenaw-Kalkaska	IVe	---	---	---	---	2.5	1.9	---
22B------------- Abbaye-Munising	IIIe	70	---	---	---	---	3.0	1.9
23A------------- Zeba-Jacobsville	IIIw	---	---	---	---	3.5	3.0	---
24B------------- Deerton	IVs	---	---	---	---	---	---	---
25-------------- Lupton and Cathro	VIw	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Oats	Irish potatoes	Corn silage	Straw-berries	Alfalfa hay	Bromegrass-alfalfa hay	Pasture
		Bu	Cwt	Tons	Crates	Tons	Tons	AUM*
26-------------- Dawson and Loxley	VIIw	---	---	---	---	---	---	---
27. Histosols and Aquents								
29B------------- Waiska	VIs	---	---	---	---	---	---	---
30B------------- Munising-Skanee	IIe	72	300	---	350	---	3.0	---
31A------------- Skanee-Gay	IIw	---	---	---	---	---	---	---
32B------------- Alcona	IIe	75	---	13	---	3.5	2.5	---
33B------------- Munising-Yalmer	IIe	66	---	---	---	---	2.5	1.2
33D------------- Munising-Yalmer	IVe	---	---	---	---	---	2.3	0.9
34B------------- Munising	IIIe	65	---	---	---	---	2.5	1.1
34D------------- Munising	VIe	---	---	---	---	---	---	---
34E------------- Munising	VIIe	---	---	---	---	---	---	---
35B------------- Graveraet	IIe	75	---	---	---	3.5	2.5	---
35D------------- Graveraet	IIIe	70	---	---	---	3.2	2.3	---
35E------------- Graveraet	VIIe	---	---	---	---	---	---	---
36A------------- Sturgeon	IIIw	80	---	---	---	4.0	2.8	---
37-------------- Arnheim	Vw	---	---	---	---	---	---	---
38A------------- Pelkie	IVs	50	---	---	---	2.5	---	---
41A------------- Misery	IIw	---	---	---	---	---	---	---
45**. Pits, borrow								
46B------------- Karlin-Kalkaska	IVs	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Oats	Irish potatoes	Corn silage	Straw-berries	Alfalfa hay	Bromegrass-alfalfa hay	Pasture
		Bu	Cwt	Tons	Crates	Tons	Tons	AUM*
46D------------- Karlin-Kalkaska	IVs	---	---	---	---	---	---	---
47B------------- Ocqueoc-Halfaday	IIIs	---	---	---	---	---	---	---
51A------------- Allendale-Rudyard	IIIw	77	---	---	---	---	2.8	---
52B------------- Allouez	VIs	---	---	---	---	---	---	---
55**. Dumps, mine								
56-------------- Jacobsville	Vw	---	---	---	---	---	---	---
58B------------- Manistee-Ontonagon	IIIs	---	---	---	---	---	---	---
59B------------- Graveraet-Ocqueoc-Kalkaska	IIIe	67	---	---	---	3.4	2.4	---
60B------------- Nunica-Fence	IIIe	70	---	12	---	---	3.6	---
60D------------- Nunica-Fence	VIe	---	---	---	---	---	---	---
60E------------- Nunica-Fence	VIIe	---	---	---	---	---	---	---
61B------------- Ontonagon	IIIe	75	---	---	---	---	3.0	---
61D------------- Ontonagon	IVe	---	---	---	---	---	2.8	---
61E------------- Ontonagon	VIIe	---	---	---	---	---	---	---
65A------------- Rudyard	IIIw	80	---	---	---	---	2.8	---
66B------------- Munising-Abbaye-Kalkaska	VIs	---	---	---	---	---	---	---
66D------------- Munising-Abbaye-Kalkaska	VIe	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Oats	Irish potatoes	Corn silage	Straw-berries	Alfalfa hay	Bromegrass-alfalfa hay	Pasture
		Bu	Cwt	Tons	Crates	Tons	Tons	AUM*
66F: Munising-Abbaye-Kalkaska	VIIe	---	---	---	---	---	---	---
67: Roscommon	VIw	---	---	---	---	---	---	---
68**. Dumps, stamp sand								
69B: Watton-Alstad	IIe	75	---	---	---	2.8	---	---
70B: Watton	IIe	75	---	---	---	3.0	---	---
71A: Richter	IIw	---	---	---	---	---	---	---
72A: Halfaday	IIIs	---	---	---	---	---	---	---
73B: Froberg-Rudyard	IIIe	74	---	---	---	---	---	---
75A: Croswell-Au Gres	IVw	---	---	---	---	---	---	---
76A: Au Gres-Kinross	VIw	---	---	---	---	---	---	---
77: Tawas-Roscommon	VIw	---	---	---	---	---	---	---
78B: Deer Park	VIIs	---	---	---	---	---	---	---
79B: Yalmer-Assinins	IIIs	---	---	---	---	---	---	---
83. Udipsamments and Udorthents								
84B: Graveraet	IIIe	---	---	---	---	---	---	---
84D: Graveraet	VIe	---	---	---	---	---	---	---
84E: Graveraet	VIIe	---	---	---	---	---	---	---
86B: Trimountain	IIIe	70	300	---	400	---	3.0	---
86D: Trimountain	IVe	65	250	---	---	---	2.5	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Oats	Irish potatoes	Corn silage	Straw-berries	Alfalfa hay	Bromegrass-alfalfa hay	Pasture
		Bu	Cwt	Tons	Crates	Tons	Tons	AUM*
86E------------- Trimountain	VIIe	---	---	---	---	---	---	---
89B------------- Trimountain-Paavola	IIIe	70	250	---	350	---	---	---
89D------------- Trimountain-Paavola	IVe	---	---	---	---	---	---	---
89E------------- Trimountain-Paavola	VIIe	---	---	---	---	---	---	---
90-------------- Witbeck	VIIs	---	---	---	---	---	---	---
92B**, 92D**, 92E**---------- Arcadian-Michigamme-Rock outcrop	VIIs	---	---	---	---	---	---	---
95A------------- Assinins-Skanee	IIIw	---	---	---	---	---	---	---
96B------------- Liminga	IIIs	40	250	10	---	2.8	1.9	---
96D------------- Liminga	IIIe	35	250	9	---	2.6	1.8	---
96E------------- Liminga	VIe	---	---	---	---	---	---	---
96F------------- Liminga	VIIe	---	---	---	---	---	---	---
98B------------- Munising-Yalmer	IIIe	61	---	---	---	---	2.5	1.0
98D------------- Munising-Yalmer	VIe	---	---	---	---	---	---	---
98E------------- Munising-Yalmer	VIIe	---	---	---	---	---	---	---
100A------------ Au Gres-Roscommon	VIw	---	---	---	---	---	---	---
101A------------ Net	VIIs	---	---	---	---	---	---	---
102A------------ Net-Witbeck	VIIs	---	---	---	---	---	---	---
103B------------ Trimountain-Net	IVe	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Oats	Irish potatoes	Corn silage	Straw-berries	Alfalfa hay	Bromegrass-alfalfa hay	Pasture
		Bu	Cwt	Tons	Crates	Tons	Tons	AUM*
104D. Urban land-Udorthents								
106B, 106D, 106E. Urban land-Udorthents-Udipsamments								
107B------------ Kalkaska-Waiska	IVs	---	---	---	---	---	---	---
107D------------ Kalkaska-Waiska	VIs	---	---	---	---	---	---	---
107E------------ Kalkaska-Waiska	VIIs	---	---	---	---	---	---	---
108B------------ Freda	VIs	---	---	---	---	---	---	---
110D, 110E------ Kalkaska-Waiska	VIIs	---	---	---	---	---	---	---
115B------------ Trimountain-Paavola	IVe	---	---	---	---	---	---	---
115D------------ Trimountain-Paavola	VIe	---	---	---	---	---	---	---
115E------------ Trimountain-Paavola	VIIe	---	---	---	---	---	---	---
116B, 116D------ Trimountain-Paavola-Michigamme	VIs	---	---	---	---	---	---	---
116E------------ Trimountain-Paavola-Michigamme	VIIs	---	---	---	---	---	---	---
119A------------ Net-Witbeck	VIIw	---	---	---	---	---	---	---
125------------- Kinross-Dawson	VIIw	---	---	---	---	---	---	---
127B------------ Keweenaw-Kalkaska	IIIe	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Oats	Irish potatoes	Corn silage	Straw-berries	Alfalfa hay	Bromegrass-alfalfa hay	Pasture
		Bu	Cwt	Tons	Crates	Tons	Tons	AUM*
127D------------ Keweenaw-Kalkaska	VIe	---	---	---	---	---	---	---
127E------------ Keweenaw-Kalkaska	VIIe	---	---	---	---	---	---	---
130B------------ Munising-Alcona-Liminga	IIIe	---	---	---	---	---	---	---
130D------------ Munising-Alcona-Liminga	VIe	---	---	---	---	---	---	---
130F------------ Munising-Alcona-Liminga	VIIe	---	---	---	---	---	---	---
131B------------ Graveraet-Misery	IIe	---	---	---	---	3.0	2.0	---
132B------------ Kalkaska-Alcona	IVs	---	---	---	---	2.3	1.7	---
132D------------ Kalkaska-Alcona	VIIs	---	---	---	---	---	---	---
132F------------ Kalkaska-Alcona	VIIs	---	---	---	---	---	---	---
133B------------ Liminga-Alcona	IIIs	55	---	11	---	3.1	2.1	---
133D------------ Liminga-Alcona	IIIe	48	---	10	---	2.8	2.0	---
133E------------ Liminga-Alcona	VIe	---	---	---	---	---	---	---
134A------------ Halfaday-Au Gres	IIIs	---	---	10	---	---	---	---
135D------------ Deer Park-Kinross	VIIs	---	---	---	---	---	---	---
136B------------ Michigamme-Net	VIs	---	---	---	---	---	---	---
137A------------ Sturgeon-Arnheim-Pelkie	IIIw	---	---	---	---	---	---	---
138------------- Bergland	Vw	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Oats	Irish potatoes	Corn silage	Straw-berries	Alfalfa hay	Bromegrass-alfalfa hay	Pasture
		Bu	Cwt	Tons	Crates	Tons	Tons	AUM*
139B------------ Trimountain-Paavola-Waiska	VIs	---	---	---	---	---	2.5	---
139D------------ Trimountain-Paavola-Waiska	VIs	---	---	---	---	---	---	---
139E------------ Trimountain-Paavola-Waiska	VIIs	---	---	---	---	---	---	---
140B------------ Trimountain-Paavola-Waiska	IVe	---	---	---	---	---	---	---
140D------------ Trimountain-Paavola-Waiska	VIe	---	---	---	---	---	---	---
140E------------ Trimountain-Paavola-Waiska	VIIe	---	---	---	---	---	---	---
142F------------ Keweenaw-Kalkaska-Waiska	VIIe	---	---	---	---	---	---	---
144F------------ Graveraet-Kalkaska	VIIe	---	---	---	---	---	---	---
145B------------ Kalkaska-Halfaday	IVs	---	---	---	---	---	---	---
146------------- Cathro-Gay	VIw	---	---	---	---	---	---	---
147B------------ Munising-Liminga-Alcona	IIe	65	---	---	---	---	2.6	---
148B------------ Graveraet-Ocqueoc-Kalkaska	IIIe	---	---	---	---	3.1	2.3	---
148D------------ Graveraet-Ocqueoc-Kalkaska	VIe	---	---	---	---	---	---	---
150B------------ Richter-Alcona	IIw	---	---	---	---	---	---	---
151B------------ Champion	VIs	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Oats	Irish potatoes	Corn silage	Straw-berries	Alfalfa hay	Bromegrass-alfalfa hay	Pasture
		Bu	Cwt	Tons	Crates	Tons	Tons	AUM*
152B------------ Kallio	VIs	---	---	---	---	---	---	---
153B, 153D------ Champion-Karlin-Fence	VIs	---	---	---	---	---	---	---
153E------------ Champion-Karlin-Fence	VIIs	---	---	---	---	---	---	---
154B------------ Vilas-Rubicon	IVs	---	---	---	---	---	---	---
154E------------ Vilas-Rubicon	VIIs	---	---	---	---	---	---	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	98,151	82,938	15,213	---
III	164,116	115,370	19,677	29,069
IV	53,969	20,891	6,035	27,043
V	6,205	---	6,205	---
VI	73,843	7,410	35,695	30,738
VII	83,668	49,018	12,788	21,862
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
10B, 10D-------- Munising	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	63	39	Norway spruce, white spruce, red pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Red maple-----------	---	---	
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						White spruce--------	---	---	
10E------------- Munising	3R	Moderate	Moderate	Slight	Moderate	Sugar maple---------	63	39	Norway spruce, white spruce, red pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Red maple-----------	---	---	
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						White spruce--------	---	---	
						Quaking aspen-------	---	---	
11A------------- Skanee	3W	Slight	Severe	Moderate	Severe	Red maple-----------	60	38	White spruce, eastern white pine.
						Sugar maple---------	60	38	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						Paper birch---------	---	---	
						Northern whitecedar-	---	---	
12-------------- Gay	7W	Slight	Severe	Severe	Severe	Balsam fir----------	53	102	
						Red maple-----------	62	39	
						Northern whitecedar-	---	---	
						White spruce--------	---	---	
						Paper birch---------	---	---	
						Eastern hemlock-----	---	---	
						Yellow birch--------	---	---	
						Quaking aspen-------	---	---	
14A------------- Assinins	3W	Slight	Severe	Moderate	Severe	Red maple-----------	65	40	White spruce, Norway spruce.
						American basswood---	---	---	
						Eastern hemlock-----	---	---	
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Quaking aspen-------	---	---	
						White spruce--------	---	---	
						Sugar maple---------	---	---	
15B, 15D-------- Kalkaska	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	64	40	Red pine.
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	63	39	
						Bigtooth aspen------	80	94	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	Volume*	
15E------------- Kalkaska	3R	Moderate	Moderate	Moderate	Slight	Sugar maple---------	64	40	Red pine.
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	63	39	
						Bigtooth aspen------	80	94	
16B, 16D-------- Rubicon	4S	Slight	Moderate	Moderate	Slight	Quaking aspen-------	60	64	Red pine, jack pine.
						Jack pine-----------	53	73	
						Red pine------------	53	82	
						Bigtooth aspen------	66	75	
						Northern red oak----	---	---	
						Red maple-----------	57	36	
						Paper birch---------	---	---	
						Eastern white pine--	45	75	
17A------------- Croswell	5S	Slight	Moderate	Moderate	Moderate	Quaking aspen-------	68	78	Red pine, eastern white pine, white spruce.
						Red pine------------	55	88	
						Jack pine-----------	53	73	
						Northern red oak----	---	---	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Bigtooth aspen------	---	---	
						Red maple-----------	---	---	
18A------------- Au Gres	6W	Slight	Severe	Moderate	Severe	Quaking aspen-------	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						Yellow birch--------	---	---	
						Red maple-----------	---	---	
						Eastern hemlock-----	---	---	
						Eastern white pine--	---	---	
						Northern whitecedar-	---	---	
21B**, 21D**:									
Keweenaw-------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	
						Eastern hemlock-----	---	---	
						Yellow birch--------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
Kalkaska-------	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	64	40	Red pine.
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	63	39	
						Bigtooth aspen------	80	94	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Management concerns: Equip-ment limita-tion	Management concerns: Seedling mortal-ity	Management concerns: Wind-throw hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
22B**:									
Abbaye	3W	Slight	Moderate	Slight	Moderate	Sugar maple	62	39	White spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
Munising	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
23A**:									
Zeba	2W	Slight	Moderate	Slight	Moderate	Red maple	55	35	White spruce, eastern white pine.
						Yellow birch	---	---	
						Balsam fir	---	---	
						White spruce	---	---	
						Bigtooth aspen	---	---	
						Paper birch	---	---	
						Quaking aspen	---	---	
						Eastern hemlock	---	---	
						Sugar maple	---	---	
Jacobsville	2W	Slight	Severe	Severe	Severe	Red maple	55	35	
						Balsam fir	---	---	
						Yellow birch	---	---	
						Quaking aspen	---	---	
						Eastern hemlock	---	---	
24B Deerton	3D	Slight	Slight	Moderate	Moderate	Sugar maple	60	38	Red pine, jack pine.
						Quaking aspen	---	---	
						American basswood	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						Red maple	---	---	
						Yellow birch	---	---	
						Bigtooth aspen	---	---	
						Eastern hemlock	---	---	
25**:									
Lupton	2W	Slight	Severe	Severe	Severe	Black spruce	20	29	
						Balsam fir	46	86	
						Black ash	---	---	
						Northern whitecedar	---	---	
						Paper birch	---	---	
						Tamarack	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						White spruce	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Common trees	Site index	Volume*	
25**:									
Cathro	5W	Slight	Severe	Severe	Severe	Balsam fir	40	71	
						Northern whitecedar	---	---	
						Tamarack	35	23	
						Paper birch	---	---	
						Red maple	---	---	
						Black spruce	15	23	
						White spruce	---	---	
26**:									
Dawson	2W	Slight	Severe	Severe	Severe	Black spruce	15	23	
						Tamarack	---	---	
Loxley	2W	Slight	Severe	Severe	Severe	Black spruce	15	23	
						Tamarack	---	---	
						Balsam fir	---	---	
29B Waiska	3S	Slight	Moderate	Moderate	Slight	Sugar maple	61	38	Red pine, jack pine.
						Eastern hemlock	---	---	
						Quaking aspen	71	82	
						Paper birch	---	---	
						American basswood	---	---	
						Yellow birch	---	---	
						Balsam fir	---	---	
30B**:									
Munising	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
Skanee	3W	Slight	Severe	Moderate	Severe	Red maple	60	38	White spruce, eastern white pine.
						Sugar maple	60	38	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Balsam fir	---	---	
						Quaking aspen	---	---	
						Paper birch	---	---	
						Northern whitecedar	---	---	
31A**:									
Skanee	3W	Slight	Severe	Moderate	Severe	Red maple	60	38	White spruce, eastern white pine.
						Sugar maple	60	38	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Balsam fir	---	---	
						Quaking aspen	---	---	
						Paper birch	---	---	
						Northern whitecedar	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Common trees	Site index	Volume*	
31A**:									
Gay	7W	Slight	Severe	Severe	Severe	Balsam fir	53	102	
						Red maple	62	39	
						Northern whitecedar	---	---	
						White spruce	---	---	
						Paper birch	---	---	
						Eastern hemlock	---	---	
						Yellow birch	---	---	
						Quaking aspen	---	---	
32B Alcona	3L	Slight	Moderate	Slight	Slight	Sugar maple	61	38	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Yellow birch	---	---	
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
						Red pine	---	---	
33B**, 33D**:									
Munising	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
Yalmer	3D	Slight	Moderate	Moderate	Moderate	Sugar maple	61	38	Red pine, Norway spruce, European larch.
						Yellow birch	---	---	
						Balsam fir	---	---	
						Eastern hemlock	---	---	
						Red maple	61	38	
						Paper birch	---	---	
						Quaking aspen	---	---	
34B Munising	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
34D Munising	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Quaking aspen	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
34E------------- Munising	3R	Severe	Severe	Slight	Moderate	Sugar maple---------	63	39	Norway spruce, white spruce, red pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Red maple-----------	---	---	
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						White spruce--------	---	---	
						Quaking aspen-------	---	---	
35B, 35D-------- Graveraet	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	60	38	Red pine, white spruce, eastern white pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						American basswood---	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
35E------------- Graveraet	3R	Moderate	Moderate	Slight	Moderate	Sugar maple---------	60	38	Red pine, eastern white pine, white spruce.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						American basswood---	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
36A------------- Sturgeon	3W	Slight	Severe	Moderate	Severe	Red maple-----------	65	40	White spruce, Norway spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
						Eastern hemlock-----	---	---	
						White spruce--------	---	---	
						Northern whitecedar-	---	---	
						American elm--------	---	---	
						Sugar maple---------	---	---	
						Silver maple--------	80	34	
37-------------- Arnheim	5W	Slight	Severe	Moderate	Severe	White spruce--------	38	68	
						Northern whitecedar-	---	---	
						Red maple-----------	---	---	
						Balsam fir----------	---	---	
						Black spruce--------	---	---	
						Paper birch---------	---	---	
						American elm--------	---	---	
						Quaking aspen-------	---	---	
						Tamarack------------	---	---	
38A------------- Pelkie	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	Red pine, white spruce, Norway spruce.
						American elm--------	---	---	
						Red maple-----------	---	---	
						American basswood---	---	---	
						Yellow birch--------	---	---	
						White spruce--------	---	---	
						American basswood---	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
41A------------- Misery	3W	Slight	Severe	Moderate	Severe	Red maple-----------	60	38	White spruce, eastern white pine.
						Sugar maple---------	---	---	
						Black ash-----------	---	---	
						Yellow birch--------	---	---	
						Eastern white pine--	---	---	
						Balsam fir----------	---	---	
						Eastern hemlock-----	---	---	
						White spruce--------	---	---	
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Northern whitecedar-	---	---	
						White ash-----------	---	---	
46B**, 46D**:									
Karlin---------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	Red pine, eastern white pine.
						Yellow birch--------	---	---	
						Bigtooth aspen------	---	---	
						Northern red oak----	---	---	
						American basswood---	---	---	
						Red pine------------	65	117	
						Eastern white pine--	---	---	
Kalkaska-------	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	64	40	Red pine.
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	63	39	
						Bigtooth aspen------	80	94	
47B**:									
Ocqueoc--------	3S	Slight	Moderate	Slight	Slight	Sugar maple---------	63	39	Red pine, eastern white pine, white spruce.
						Yellow birch--------	---	---	
						Quaking aspen-------	---	---	
						Eastern white pine--	---	---	
						Red pine------------	---	---	
						Jack pine-----------	---	---	
						Paper birch---------	---	---	
						Red maple-----------	---	---	
Halfaday-------	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	62	39	Red pine, eastern white pine, white spruce.
						Red pine------------	---	---	
						Quaking aspen-------	---	---	
						Jack pine-----------	63	91	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Bigtooth aspen------	80	94	
						Red maple-----------	60	38	
						Paper birch---------	---	---	
51A**:									
Allendale------	4W	Slight	Severe	Moderate	Moderate	Quaking aspen-------	60	64	White spruce, eastern white pine.
						White ash-----------	---	---	
						Eastern white pine--	---	---	
						White spruce--------	---	---	
						Paper birch---------	---	---	
						Balsam fir----------	---	---	
						Red maple-----------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
51A**:									
Rudyard--------	6W	Slight	Severe	Moderate	Severe	White spruce--------	45	84	White spruce, eastern white pine.
						Balsam fir----------	45	83	
						Quaking aspen-------	---	---	
						Northern whitecedar-	---	---	
						Eastern hemlock-----	---	---	
						Black ash-----------	---	---	
						Red maple-----------	---	---	
						American basswood---	---	---	
52B------------- Alllouez	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	White spruce, red pine.
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Yellow birch--------	---	---	
						White spruce--------	---	---	
						Eastern hemlock-----	---	---	
56-------------- Jacobsville	2W	Slight	Severe	Severe	Severe	Red maple-----------	55	35	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Quaking aspen-------	---	---	
						Eastern hemlock-----	---	---	
58B**:									
Manistee-------	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	61	38	Red pine, eastern white pine.
						Eastern white pine--	---	---	
						Red maple-----------	---	---	
						Red pine------------	---	---	
						American basswood---	---	---	
						Eastern hemlock-----	---	---	
						Northern red oak----	---	---	
						White ash-----------	---	---	
Ontonagon------	2C	Slight	Severe	Slight	Moderate	Red maple-----------	55	35	White spruce, eastern white pine, northern whitecedar.
						Eastern white pine--	44	75	
						Yellow birch--------	---	---	
						Northern whitecedar-	---	---	
						Eastern hemlock-----	---	---	
						White spruce--------	---	---	
						Balsam fir----------	---	---	
59B**:									
Graveraet------	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	60	38	Red pine, white spruce, eastern white pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						American basswood---	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
Ocqueoc--------	3S	Slight	Moderate	Slight	Slight	Sugar maple---------	63	39	Red pine, eastern white pine, white spruce.
						Yellow birch--------	---	---	
						Quaking aspen-------	---	---	
						Eastern white pine--	---	---	
						Red pine------------	---	---	
						Jack pine-----------	---	---	
						Paper birch---------	---	---	
						Red maple-----------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
59B**:									
Kalkaska	3S	Slight	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
60B**:									
Nunica	3L	Slight	Moderate	Slight	Slight	Sugar maple	62	39	White spruce, red pine, eastern white pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						American basswood	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Balsam fir	---	---	
Fence	3L	Slight	Severe	Slight	Slight	Sugar maple	65	40	Red pine, eastern white pine, white spruce.
						Yellow birch	---	---	
						American basswood	---	---	
						Quaking aspen	---	---	
						Bigtooth aspen	---	---	
60D**:									
Nunica	3R	Moderate	Moderate	Slight	Slight	Sugar maple	62	39	White spruce, red pine, eastern white pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						American basswood	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Balsam fir	---	---	
Fence	3R	Moderate	Severe	Slight	Slight	Sugar maple	65	40	Red pine, eastern white pine, white spruce.
						Yellow birch	---	---	
						American basswood	---	---	
						Quaking aspen	---	---	
						Bigtooth aspen	---	---	
60E**:									
Nunica	3R	Severe	Severe	Slight	Slight	Sugar maple	62	39	White spruce, red pine, eastern white pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						American basswood	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Balsam fir	---	---	
Fence	3R	Moderate	Severe	Slight	Slight	Sugar maple	65	40	Red pine, eastern white pine, white spruce.
						Yellow birch	---	---	
						American basswood	---	---	
						Quaking aspen	---	---	
						Bigtooth aspen	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
61B, 61D-------- Ontonagon	2C	Slight	Severe	Slight	Moderate	Red maple-----------	55	35	White spruce, eastern white pine, northern whitecedar.
						Eastern white pine--	44	75	
						Yellow birch--------	---	---	
						Northern whitecedar-	---	---	
						Eastern hemlock-----	---	---	
						White spruce--------	---	---	
						Balsam fir----------	---	---	
61E------------- Ontonagon	2R	Moderate	Severe	Slight	Moderate	Red maple-----------	55	35	White spruce, eastern white pine, northern whitecedar.
						Eastern white pine--	44	75	
						Yellow birch--------	---	---	
						Northern whitecedar-	---	---	
						Eastern hemlock-----	---	---	
						White spruce--------	---	---	
						Balsam fir----------	---	---	
65A------------- Rudyard	6W	Slight	Severe	Moderate	Severe	White spruce--------	45	84	White spruce, eastern white pine.
						Balsam fir----------	45	83	
						Quaking aspen-------	---	---	
						Northern whitecedar-	---	---	
						Eastern hemlock-----	---	---	
						Black ash-----------	---	---	
						Red maple-----------	---	---	
						American basswood---	---	---	
66B**:									
Munising-------	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	63	39	Norway spruce, white spruce, red pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Red maple-----------	---	---	
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						White spruce--------	---	---	
Abbaye---------	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	62	39	White spruce, red pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
Kalkaska-------	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	64	40	Red pine.
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	63	39	
						Bigtooth aspen------	80	94	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
66D**:									
Munising	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Quaking aspen	---	---	
Abbaye	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	62	39	White spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	65	40	
						Quaking aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
Kalkaska	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
66F**:									
Munising	3R	Severe	Severe	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Quaking aspen	---	---	
Abbaye	3R	Severe	Severe	Slight	Moderate	Sugar maple	62	39	White spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	65	40	
						Quaking aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
Kalkaska	3R	Severe	Severe	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						American beech	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
67----------- Roscommon	6W	Slight	Severe	Severe	Severe	Quaking aspen-------	74	86	
						Black spruce--------	---	---	
						Northern whitecedar-	---	---	
						Jack pine-----------	---	---	
						Balsam fir----------	---	---	
						Red maple-----------	---	---	
						Yellow birch--------	---	---	
69B**:									
Watton---------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	62	39	Red pine, white spruce.
						Yellow birch--------	---	---	
						American basswood---	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						White spruce--------	---	---	
						Red maple-----------	---	---	
Alstad---------	3W	Slight	Severe	Slight	Moderate	Red maple-----------	65	40	Eastern white pine, white spruce, black spruce.
						American basswood---	---	---	
						American elm--------	---	---	
						Quaking aspen-------	---	---	
						Sugar maple---------	---	---	
						Bigtooth aspen------	---	---	
70B------------ Watton	3A	Slight	Slight	Slight	Slight	Sugar maple---------	62	39	Red pine, white spruce.
						Yellow birch--------	---	---	
						American basswood---	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						White spruce--------	---	---	
						Red maple-----------	---	---	
71A------------ Richter	3W	Slight	Severe	Moderate	Severe	Sugar maple---------	61	38	White spruce, northern whitecedar, eastern white pine.
						Red maple-----------	65	40	
						Balsam fir----------	---	---	
						Black ash-----------	---	---	
						Eastern hemlock-----	---	---	
						Paper birch---------	65	73	
						Quaking aspen-------	---	---	
72A------------ Halfaday	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	62	39	Red pine, eastern white pine, white spruce.
						Red pine------------	---	---	
						Quaking aspen-------	---	---	
						Jack pine-----------	63	91	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Bigtooth aspen------	80	94	
						Red maple-----------	60	38	
						Paper birch---------	---	---	
73B**:									
Froberg--------	3C	Slight	Moderate	Slight	Severe	Sugar maple---------	60	38	White spruce, eastern white pine, Norway spruce.
						Quaking aspen-------	---	---	
						Yellow birch--------	---	---	
						White spruce--------	---	---	
						Red maple-----------	---	---	
						Eastern hemlock-----	---	---	
						Balsam fir----------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
73B**:									
Rudyard	6W	Slight	Severe	Moderate	Severe	White spruce	45	84	White spruce, eastern white pine.
						Balsam fir	45	83	
						Quaking aspen	---	---	
						Northern whitecedar	---	---	
						Eastern hemlock	---	---	
						Black ash	---	---	
						Red maple	---	---	
						American basswood	---	---	
75A**:									
Croswell	5S	Slight	Moderate	Moderate	Moderate	Quaking aspen	68	78	Red pine, eastern white pine, white spruce.
						Red pine	55	90	
						Jack pine	53	73	
						Northern red oak	---	---	
						Black cherry	---	---	
						Eastern white pine	---	---	
						Bigtooth aspen	---	---	
						Red maple	---	---	
Au Gres	6W	Slight	Severe	Moderate	Severe	Quaking aspen	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
						Red maple	---	---	
						Eastern hemlock	---	---	
						Eastern white pine	---	---	
						Northern whitecedar	---	---	
76A**:									
Au Gres	6W	Slight	Severe	Moderate	Severe	Quaking aspen	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
						Red maple	---	---	
						Eastern hemlock	---	---	
						Eastern white pine	---	---	
						Northern whitecedar	---	---	
Kinross	2W	Slight	Severe	Severe	Severe	Quaking aspen	45	32	
						Black spruce	---	---	
						Tamarack	---	---	
						Northern whitecedar	---	---	
						Balsam fir	---	---	
						Red maple	---	---	
77**:									
Tawas	5W	Slight	Severe	Severe	Severe	Balsam fir	40	71	
						Northern whitecedar	---	---	
						Quaking aspen	---	---	
						Black ash	---	---	
						Red maple	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
77**:									
Roscommon------	6W	Slight	Severe	Severe	Severe	Quaking aspen-------	74	86	
						Black spruce--------	---	---	
						Northern whitecedar-	---	---	
						Jack pine-----------	---	---	
						Balsam fir----------	---	---	
						Red maple-----------	---	---	
						Yellow birch--------	---	---	
78B------------ Deer Park	4S	Slight	Moderate	Moderate	Slight	Red pine------------	45	64	Red pine, jack pine.
						Jack pine-----------	46	57	
						Eastern white pine--	---	---	
						Northern red oak----	---	---	
						American beech------	---	---	
						Quaking aspen-------	---	---	
						Paper birch---------	---	---	
						Black cherry--------	---	---	
79B**:									
Yalmer---------	3D	Slight	Moderate	Moderate	Moderate	Sugar maple---------	61	38	Red pine, Norway spruce, European larch.
						Yellow birch--------	---	---	
						Balsam fir----------	---	---	
						Eastern hemlock-----	---	---	
						Red maple-----------	61	38	
						Paper birch---------	---	---	
						Quaking aspen-------	---	---	
Assinins-------	3W	Slight	Severe	Moderate	Severe	Red maple-----------	65	40	White spruce, Norway spruce.
						American basswood---	---	---	
						Eastern hemlock-----	---	---	
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Quaking aspen-------	---	---	
						White spruce--------	---	---	
						Sugar maple---------	---	---	
84B------------ Graveraet	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	60	38	Red pine, white spruce, eastern white pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						American basswood---	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
84D------------ Graveraet	3R	Moderate	Moderate	Slight	Moderate	Sugar maple---------	60	38	Red pine, eastern white pine, white spruce.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						American basswood---	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
84E------------ Graveraet	3R	Severe	Severe	Slight	Moderate	Sugar maple---------	60	38	Red pine, eastern white pine, white spruce.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						American basswood---	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
86B, 86D: Trimountain	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
86E: Trimountain	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
89B**, 89D**:									
Trimountain	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Paavola	3W	Slight	Moderate	Moderate	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
89E**:									
Trimountain	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Paavola	3R	Moderate	Moderate	Moderate	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
90-------------- Witbeck	3X	Slight	Severe	Severe	Severe	Black spruce--------	33	44	
						Quaking aspen-------	50	43	
						White spruce--------	---	---	
						Balsam fir----------	48	90	
						Black ash-----------	---	---	
						Yellow birch--------	---	---	
						Red maple-----------	---	---	
						Northern whitecedar-	---	---	
92B**, 92D**:									
Arcadian-------	3D	Slight	Moderate	Moderate	Severe	Sugar maple---------	63	39	Eastern white pine, white spruce.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern hophornbeam-	---	---	
						White ash-----------	---	---	
Michigamme-----	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	60	38	White spruce, eastern white pine.
						Yellow birch--------	60	38	
						Balsam fir----------	---	---	
						Eastern hemlock-----	---	---	
						Bigtooth aspen------	---	---	
						Red maple-----------	---	---	
						White spruce--------	---	---	
						Black cherry--------	---	---	
Rock outcrop.									
92E**:									
Arcadian-------	3R	Moderate	Moderate	Moderate	Severe	Sugar maple---------	63	39	Eastern white pine, white spruce.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern hophornbeam-	---	---	
						White ash-----------	---	---	
Michigamme-----	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	60	38	White spruce, eastern white pine.
						Yellow birch--------	60	38	
						Balsam fir----------	---	---	
						Eastern hemlock-----	---	---	
						Bigtooth aspen------	---	---	
						Red maple-----------	---	---	
						White spruce--------	---	---	
						Black cherry--------	---	---	
Rock outcrop.									

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
95A**:									
Assinins-------	3W	Slight	Severe	Moderate	Severe	Red maple-----------	65	40	White spruce, Norway spruce.
						American basswood---	---	---	
						Eastern hemlock-----	---	---	
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Quaking aspen-------	---	---	
						White spruce--------	---	---	
						Sugar maple---------	---	---	
Skanee---------	3W	Slight	Severe	Moderate	Severe	Red maple-----------	60	38	White spruce, eastern white pine.
						Sugar maple---------	60	38	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						Paper birch---------	---	---	
						Northern whitecedar-	---	---	
96B, 96D-------- Liminga	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	60	38	Red pine, eastern white pine, white spruce.
						Red maple-----------	---	---	
						European white birch	---	---	
						Yellow birch--------	---	---	
						Hemlock-------------	---	---	
						Paper birch---------	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
96E------------- Liminga	3R	Moderate	Moderate	Moderate	Slight	Sugar maple---------	60	38	Red pine, eastern white pine, white spruce.
						Red maple-----------	---	---	
						European white birch	---	---	
						Yellow birch--------	---	---	
						Hemlock-------------	---	---	
						Paper birch---------	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
96F------------- Liminga	3R	Severe	Severe	Moderate	Slight	Sugar maple---------	60	38	Red pine, eastern white pine, white spruce.
						Red maple-----------	---	---	
						European white birch	---	---	
						Yellow birch--------	---	---	
						Hemlock-------------	---	---	
						Paper birch---------	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
98B**:									
Munising-------	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	63	38	Norway spruce, white spruce, red pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Red maple-----------	---	---	
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						White spruce--------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
98B**:									
Yalmer	3D	Slight	Moderate	Moderate	Moderate	Sugar maple	61	38	Red pine, Norway spruce, European larch.
						Yellow birch	---	---	
						Balsam fir	---	---	
						Eastern hemlock	---	---	
						Red maple	61	38	
						Paper birch	---	---	
						Quaking aspen	---	---	
98D**:									
Munising	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Quaking aspen	---	---	
Yalmer	3R	Moderate	Moderate	Moderate	Moderate	Sugar maple	61	38	White spruce, European larch, red pine.
						Balsam fir	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Quaking aspen	---	---	
						Paper birch	---	---	
						Red maple	61	38	
98E**:									
Munising	3R	Severe	Severe	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Quaking aspen	---	---	
Yalmer	3R	Severe	Severe	Moderate	Moderate	Sugar maple	61	38	White spruce, European larch, red pine.
						Balsam fir	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Quaking aspen	---	---	
						Paper birch	---	---	
						Red maple	61	38	
100A**:									
Au Gres	6W	Slight	Severe	Moderate	Severe	Quaking aspen	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
						Red maple	---	---	
						Eastern hemlock	---	---	
						Eastern white pine	---	---	
						Northern whitecedar	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	Volume*	
100A**:									
Roscommon	6W	Slight	Severe	Severe	Severe	Quaking aspen	74	86	
						Black spruce	---	---	
						Northern whitecedar	---	---	
						Jack pine	---	---	
						Balsam fir	---	---	
						Red maple	---	---	
						Yellow birch	---	---	
101A	3X	Slight	Severe	Moderate	Severe	Red maple	60	38	White spruce, eastern white pine.
Net						Balsam fir	58	113	
						Bigtooth aspen	---	---	
						Quaking aspen	---	---	
						White spruce	49	94	
						Paper birch	53	53	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
102A**:									
Net	3X	Slight	Severe	Moderate	Severe	Red maple	60	38	White spruce, eastern white pine.
						Balsam fir	58	113	
						Bigtooth aspen	---	---	
						Quaking aspen	---	---	
						White spruce	49	94	
						Paper birch	53	53	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
Witbeck	3X	Slight	Severe	Severe	Severe	Black spruce	33	44	
						Quaking aspen	50	43	
						White spruce	---	---	
						Balsam fir	48	90	
						Black ash	---	---	
						Yellow birch	---	---	
						Red maple	---	---	
						Northern whitecedar	---	---	
103B**:									
Trimountain	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Net	3X	Slight	Severe	Moderate	Severe	Red maple	60	38	White spruce, eastern white pine.
						Balsam fir	58	113	
						Bigtooth aspen	---	---	
						Quaking aspen	---	---	
						White spruce	49	94	
						Paper birch	53	53	
						Yellow birch	---	---	
						Eastern hemlock	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
107B**, 107D**:									
Kalkaska	3S	Slight	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
Waiska	3S	Slight	Moderate	Moderate	Slight	Sugar maple	61	38	Red pine, jack pine.
						Eastern hemlock	---	---	
						Quaking aspen	71	82	
						Paper birch	---	---	
						American basswood	---	---	
						Yellow birch	---	---	
						Balsam fir	---	---	
107E**:									
Kalkaska	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
Waiska.									
108B Freda	3D	Slight	Moderate	Moderate	Severe	Sugar maple	64	40	Eastern white pine, white spruce.
						Yellow birch	---	---	
						Red maple	---	---	
						American basswood	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Quaking aspen	---	---	
110D**:									
Kalkaska	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
Waiska	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	61	38	
						Eastern hemlock	---	---	
						Quaking aspen	71	82	
						Paper birch	---	---	
						American basswood	---	---	
						Yellow birch	---	---	
						Balsam fir	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	Volume*	
110E**:									
Kalkaska	3R	Severe	Severe	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
Waiska	3R	Severe	Severe	Moderate	Slight	Sugar maple	61	38	Red pine, jack pine.
						Eastern hemlock	---	---	
						Quaking aspen	71	82	
						Paper birch	---	---	
						American basswood	---	---	
						Yellow birch	---	---	
						Balsam fir	---	---	
115B**:									
Trimountain	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Paavola	3W	Slight	Moderate	Moderate	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
115D**:									
Trimountain	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Paavola	3R	Moderate	Moderate	Moderate	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
115E**:									
Trimountain	3R	Severe	Severe	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Paavola	3R	Severe	Severe	Moderate	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
116B**:									
Trimountain	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Paavola	3W	Slight	Moderate	Moderate	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Michigamme	3W	Slight	Moderate	Slight	Moderate	Sugar maple	60	38	White spruce, eastern white pine.
						Yellow birch	60	38	
						Balsam fir	---	---	
						Eastern hemlock	---	---	
						Bigtooth aspen	---	---	
						Red maple	---	---	
						White spruce	---	---	
						Black cherry	---	---	
116D**:									
Trimountain	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
116D**:									
Paavola	3R	Moderate	Moderate	Moderate	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Michigamme	3R	Moderate	Moderate	Slight	Slight	Sugar maple	60	38	White spruce, eastern white pine.
						Yellow birch	60	38	
						Balsam fir	---	---	
						Eastern hemlock	---	---	
						Bigtooth aspen	---	---	
						Red maple	---	---	
						White spruce	---	---	
						Black cherry	---	---	
116E**:									
Trimountain	3R	Severe	Severe	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Paavola	3R	Severe	Severe	Moderate	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Michigamme	3R	Severe	Severe	Slight	Slight	Sugar maple	60	38	White spruce, eastern white pine.
						Yellow birch	60	38	
						Balsam fir	---	---	
						Eastern hemlock	---	---	
						Bigtooth aspen	---	---	
						Red maple	---	---	
						White spruce	---	---	
						Black cherry	---	---	
119A**:									
Net	3X	Slight	Severe	Moderate	Severe	Red maple	60	38	White spruce, eastern white pine.
						Balsam fir	58	113	
						Bigtooth aspen	---	---	
						Quaking aspen	---	---	
						White spruce	49	94	
						Paper birch	53	55	
						Yellow birch	---	---	
						Eastern hemlock	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
119A**:									
Witbeck	3X	Slight	Severe	Severe	Severe	Black spruce	33	44	
						Quaking aspen	50	43	
						White spruce	---	---	
						Balsam fir	48	90	
						Black ash	---	---	
						Yellow birch	---	---	
						Red maple	---	---	
						Northern whitecedar	---	---	
125**:									
Kinross	2W	Slight	Severe	Severe	Severe	Quaking aspen	45	32	
						Black spruce	---	---	
						Tamarack	---	---	
						Northern whitecedar	---	---	
						Balsam fir	---	---	
						Red maple	---	---	
Dawson	2W	Slight	Severe	Severe	Severe	Black spruce	15	23	
						Tamarack	---	---	
127B**:									
Keweenaw	3A	Slight	Slight	Slight	Slight	Sugar maple	61	38	
						Eastern hemlock	---	---	
						Yellow birch	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
						Paper birch	---	---	
						Black cherry	---	---	
						Eastern white pine	---	---	
						Quaking aspen	---	---	
						Balsam fir	---	---	
Kalkaska	3S	Slight	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
127D**:									
Keweenaw	3R	Moderate	Moderate	Slight	Slight	Sugar maple	61	38	
						Eastern hemlock	---	---	
						Yellow birch	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
						Paper birch	---	---	
						Black cherry	---	---	
						Eastern white pine	---	---	
						Quaking aspen	---	---	
						Balsam fir	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
127D**:									
Kalkaska-------	3R	Moderate	Moderate	Moderate	Slight	Sugar maple---------	64	40	Red pine.
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	63	39	
						Bigtooth aspen------	80	94	
127E**:									
Keweenaw-------	3R	Severe	Severe	Slight	Slight	Sugar maple---------	61	38	
						Eastern hemlock-----	---	---	
						Yellow birch--------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
Kalkaska-------	3R	Severe	Severe	Moderate	Slight	Sugar maple---------	64	40	Red pine.
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	63	39	
						Bigtooth aspen------	80	94	
130B**:									
Munising-------	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	63	39	Norway spruce, white spruce, red pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Red maple-----------	---	---	
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						White spruce--------	---	---	
Alcona---------	3L	Slight	Moderate	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, eastern white pine.
						Red maple-----------	---	---	
						Yellow birch--------	---	---	
						American basswood---	---	---	
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						White ash-----------	---	---	
						Red pine------------	---	---	
Liminga--------	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	60	38	Red pine, eastern white pine, white spruce.
						Red maple-----------	---	---	
						European white birch	---	---	
						Yellow birch--------	---	---	
						Hemlock-------------	---	---	
						Paper birch---------	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
130D**:									
Munising	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Quaking aspen	---	---	
Alcona	3R	Moderate	Moderate	Slight	Slight	Sugar maple	61	38	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Yellow birch	---	---	
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
						Red pine	---	---	
Liminga	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	60	38	Red pine, eastern white pine, white spruce.
						Red maple	---	---	
						European white birch	---	---	
						Yellow birch	---	---	
						Hemlock	---	---	
						Paper birch	---	---	
						Quaking aspen	---	---	
						Bigtooth aspen	---	---	
130F**:									
Munising	3R	Severe	Severe	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	
						Quaking aspen	---	---	
Alcona	3R	Severe	Severe	Slight	Slight	Sugar maple	61	38	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Yellow birch	---	---	
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
						Red pine	---	---	
Liminga	3R	Severe	Severe	Moderate	Slight	Sugar maple	60	38	Red pine, eastern white pine, white spruce.
						Red maple	---	---	
						European white birch	---	---	
						Yellow birch	---	---	
						Hemlock	---	---	
						Paper birch	---	---	
						Quaking aspen	---	---	
						Bigtooth aspen	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
131B**:									
Graveraet------	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	60	38	Red pine, white spruce, eastern white pine.
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						American basswood---	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
Misery---------	3W	Slight	Severe	Moderate	Severe	Red maple-----------	60	38	White spruce, eastern white pine.
						Sugar maple---------	---	---	
						Black ash-----------	---	---	
						Yellow birch--------	---	---	
						Eastern white pine--	---	---	
						Balsam fir----------	---	---	
						Eastern hemlock-----	---	---	
						White spruce--------	---	---	
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Northern whitecedar-	---	---	
						White ash-----------	---	---	
132B**:									
Kalkaska-------	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	64	40	Red pine.
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	63	39	
						Bigtooth aspen------	80	94	
Alcona---------	3L	Slight	Moderate	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, eastern white pine.
						Red maple-----------	---	---	
						Yellow birch--------	---	---	
						American basswood---	---	---	
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						White ash-----------	---	---	
						Red pine------------	---	---	
132D**:									
Kalkaska-------	3R	Moderate	Moderate	Moderate	Slight	Sugar maple---------	64	40	Red pine.
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	63	39	
						Bigtooth aspen------	80	94	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
132D**:									
Alcona	3R	Moderate	Moderate	Slight	Slight	Sugar maple	61	38	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Yellow birch	---	---	
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
						Red pine	---	---	
132F**:									
Kalkaska	3R	Severe	Severe	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
Alcona	3R	Severe	Severe	Slight	Slight	Sugar maple	61	38	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Yellow birch	---	---	
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
						Red pine	---	---	
133B**, 133D**:									
Liminga	3S	Slight	Moderate	Moderate	Slight	Sugar maple	60	38	Red pine, eastern white pine, white spruce.
						Red maple	---	---	
						European white birch	---	---	
						Yellow birch	---	---	
						Hemlock	---	---	
						Paper birch	---	---	
						Quaking aspen	---	---	
						Bigtooth aspen	---	---	
Alcona	3L	Slight	Moderate	Slight	Slight	Sugar maple	61	38	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Yellow birch	---	---	
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
						Red pine	---	---	
133E**:									
Liminga	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	60	38	Red pine, eastern white pine, white spruce.
						Red maple	---	---	
						European white birch	---	---	
						Yellow birch	---	---	
						Hemlock	---	---	
						Paper birch	---	---	
						Quaking aspen	---	---	
						Bigtooth aspen	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
133E**:									
Alcona	3R	Moderate	Moderate	Slight	Slight	Sugar maple	61	38	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Yellow birch	---	---	
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
						Red pine	---	---	
134A**:									
Halfaday	3S	Slight	Moderate	Moderate	Slight	Sugar maple	62	39	Red pine, eastern white pine, white spruce.
						Red pine	---	---	
						Quaking aspen	---	---	
						Jack pine	63	91	
						Black cherry	---	---	
						Eastern white pine	---	---	
						Bigtooth aspen	80	94	
						Red maple	60	38	
						Paper birch	---	---	
Au Gres	6W	Slight	Severe	Moderate	Severe	Quaking aspen	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
						Red maple	---	---	
						Eastern hemlock	---	---	
						Eastern white pine	---	---	
						Northern whitecedar	---	---	
135D**:									
Deer Park	4S	Slight	Moderate	Moderate	Slight	Red pine	45	64	Red pine, jack pine.
						Jack pine	46	57	
						Eastern white pine	---	---	
						Northern red oak	---	---	
						Quaking aspen	---	---	
						Paper birch	---	---	
						Black cherry	---	---	
Kinross	2W	Slight	Severe	Severe	Severe	Quaking aspen	45	32	
						Black spruce	---	---	
						Tamarack	---	---	
						Northern whitecedar	---	---	
						Balsam fir	---	---	
						Red maple	---	---	
136B**:									
Michigamme	3W	Slight	Moderate	Slight	Moderate	Sugar maple	60	38	White spruce, eastern white pine.
						Yellow birch	60	38	
						Balsam fir	---	---	
						Eastern hemlock	---	---	
						Bigtooth aspen	---	---	
						Red maple	---	---	
						White spruce	---	---	
						Black cherry	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Common trees	Site index	Volume*	
136B**:									
Net	3X	Slight	Severe	Moderate	Severe	Red maple	60	38	White spruce, eastern white pine.
						Balsam fir	58	113	
						Bigtooth aspen	---	---	
						Quaking aspen	---	---	
						White spruce	49	94	
						Paper birch	53	53	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
137A**:									
Sturgeon	3W	Slight	Severe	Moderate	Severe	Red maple	65	40	White spruce, Norway spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Quaking aspen	---	---	
						Balsam fir	---	---	
						Eastern hemlock	---	---	
						White spruce	---	---	
						Northern whitecedar	---	---	
						American elm	---	---	
						Sugar maple	---	---	
						Silver maple	80	34	
Arnheim	5W	Slight	Severe	Moderate	Severe	White spruce	38	68	
						Northern whitecedar	---	---	
						Red maple	---	---	
						Balsam fir	---	---	
						Black spruce	---	---	
						Paper birch	---	---	
						American elm	---	---	
						Quaking aspen	---	---	
						Tamarack	---	---	
Pelkie	3A	Slight	Slight	Slight	Slight	Sugar maple	65	40	Red pine, white spruce, Norway spruce.
						American elm	---	---	
						Red maple	---	---	
						American basswood	---	---	
						Yellow birch	---	---	
						White spruce	---	---	
138 Bergland	6W	Slight	Severe	Severe	Severe	White spruce	45	84	White spruce, northern whitecedar, eastern white pine.
						Balsam fir	45	83	
						Paper birch	---	---	
						Quaking aspen	74	86	
						Northern whitecedar	---	---	
						Red maple	---	---	
						Black ash	---	---	
						American basswood	---	---	
						Tamarack	---	---	
139B**, 139D**:									
Trimountain	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
139B**, 139D**:									
Paavola--------	3W	Slight	Moderate	Moderate	Moderate	Sugar maple---------	63	39	White spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	
Waiska---------	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	61	38	Red pine, jack pine.
						Eastern hemlock-----	---	---	
						Quaking aspen-------	71	82	
						Paper birch---------	---	---	
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Balsam fir----------	---	---	
139E**:									
Trimountain----	3R	Moderate	Moderate	Slight	Moderate	Sugar maple---------	63	39	White spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	
Paavola--------	3R	Moderate	Moderate	Moderate	Moderate	Sugar maple---------	63	39	White spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	
Waiska---------	3R	Moderate	Moderate	Moderate	Slight	Sugar maple---------	61	38	
						Eastern hemlock-----	---	---	
						Quaking aspen-------	71	82	
						Paper birch---------	---	---	
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Balsam fir----------	---	---	
140B**:									
Trimountain----	3W	Slight	Moderate	Slight	Moderate	Sugar maple---------	63	39	White spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
140B**:									
Paavola--------	3W	Slight	Moderate	Moderate	Moderate	Sugar maple---------	63	39	White spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	
Waiska---------	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	61	38	Red pine, jack pine.
						Eastern hemlock-----	---	---	
						Quaking aspen-------	71	82	
						Paper birch---------	---	---	
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Balsam fir----------	---	---	
140D**:									
Trimountain----	3R	Moderate	Moderate	Slight	Moderate	Sugar maple---------	63	39	White spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	
Paavola--------	3R	Moderate	Moderate	Moderate	Moderate	Sugar maple---------	63	39	White spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	
Waiska---------	3R	Moderate	Moderate	Moderate	Slight	Sugar maple---------	61	38	
						Eastern hemlock-----	---	---	
						Quaking aspen-------	71	82	
						Paper birch---------	---	---	
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Balsam fir----------	---	---	
140E**:									
Trimountain----	3R	Severe	Severe	Slight	Moderate	Sugar maple---------	63	39	White spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Eastern hophornbeam-	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
140E**:									
Paavola	3R	Severe	Severe	Moderate	Moderate	Sugar maple	63	39	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
Waiska	3R	Severe	Severe	Moderate	Slight	Sugar maple	61	38	Red pine, jack pine.
						Eastern hemlock	---	---	
						Quaking aspen	71	82	
						Paper birch	---	---	
						American basswood	---	---	
						Yellow birch	---	---	
						Balsam fir	---	---	
142F**:									
Keweenaw	3R	Severe	Severe	Slight	Slight	Sugar maple	61	38	
						Eastern hemlock	---	---	
						Yellow birch	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
						Paper birch	---	---	
						Black cherry	---	---	
						Eastern white pine	---	---	
						Quaking aspen	---	---	
						Balsam fir	---	---	
Kalkaska	3R	Severe	Severe	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
Waiska	3R	Severe	Severe	Moderate	Slight	Sugar maple	61	38	Red pine, jack pine.
						Eastern hemlock	---	---	
						Quaking aspen	71	82	
						Paper birch	---	---	
						American basswood	---	---	
						Yellow birch	---	---	
						Balsam fir	---	---	
144F**:									
Graveraet	3R	Severe	Severe	Slight	Moderate	Sugar maple	60	38	Red pine, eastern white pine, white spruce.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						American basswood	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
144F**:									
Kalkaska	3R	Severe	Severe	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
145B**:									
Kalkaska	3S	Slight	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
Halfaday	3S	Slight	Moderate	Moderate	Slight	Sugar maple	62	39	Red pine, eastern white pine, white spruce.
						Red pine	---	---	
						Quaking aspen	---	---	
						Jack pine	63	91	
						Black cherry	---	---	
						Eastern white pine	---	---	
						Bigtooth aspen	80	94	
						Red maple	60	38	
						Paper birch	---	---	
146**:									
Cathro	5W	Slight	Severe	Severe	Severe	Balsam fir	40	71	
						Northern whitecedar	---	---	
						Tamarack	35	23	
						Paper birch	---	---	
						Red maple	---	---	
						Black spruce	15	23	
						White spruce	---	---	
Gay	7W	Slight	Severe	Severe	Severe	Balsam fir	53	102	
						Red maple	62	39	
						Northern whitecedar	---	---	
						White spruce	---	---	
						Paper birch	---	---	
						Eastern hemlock	---	---	
						Yellow birch	---	---	
						Quaking aspen	---	---	
147B**:									
Munising	3W	Slight	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
						White spruce	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
147B**:									
Liminga	3S	Slight	Moderate	Moderate	Slight	Sugar maple	60	38	Red pine, eastern white pine, white spruce.
						Red maple	---	---	
						European white birch	---	---	
						Yellow birch	---	---	
						Hemlock	---	---	
						Paper birch	---	---	
						Quaking aspen	---	---	
						Bigtooth aspen	---	---	
Alcona	3L	Slight	Moderate	Slight	Slight	Sugar maple	61	38	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Yellow birch	---	---	
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
						Red pine	---	---	
148B**:									
Graveraet	3W	Slight	Moderate	Slight	Moderate	Sugar maple	60	38	Red pine, white spruce, eastern white pine.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						American basswood	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	
Ocqueoc	3S	Slight	Moderate	Slight	Slight	Sugar maple	63	39	Red pine, eastern white pine, white spruce.
						Yellow birch	---	---	
						Quaking aspen	---	---	
						Eastern white pine	---	---	
						Red pine	---	---	
						Jack pine	---	---	
						Paper birch	---	---	
						Red maple	---	---	
Kalkaska	3S	Slight	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
148D**:									
Graveraet	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	60	38	Red pine, eastern white pine, white spruce.
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						American basswood	---	---	
						Eastern hophornbeam	---	---	
						Red maple	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
148D**:									
Ocqueoc	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	63	39	Red pine, white spruce, eastern white pine.
						Yellow birch	---	---	
						Quaking aspen	---	---	
						Eastern white pine	---	---	
						Red pine	---	---	
						Jack pine	---	---	
						Peper birch	---	---	
						Red maple	---	---	
Kalkaska	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine.
						Quaking aspen	---	---	
						Red pine	---	---	
						Eastern white pine	---	---	
						Paper birch	---	---	
						Northern red oak	---	---	
						Red maple	63	39	
						Bigtooth aspen	80	94	
150B**:									
Richter	3W	Slight	Severe	Moderate	Severe	Sugar maple	61	38	White spruce, northern whitecedar, eastern white pine.
						Red maple	65	40	
						Balsam fir	---	---	
						Black ash	---	---	
						Eastern hemlock	---	---	
						Paper birch	65	73	
						Quaking aspen	---	---	
Alcona	3L	Slight	Moderate	Slight	Slight	Sugar maple	61	38	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Yellow birch	---	---	
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
						Red pine	---	---	
151B Champion	3X	Slight	Severe	Slight	Moderate	Sugar maple	60	38	White spruce, eastern white pine.
						American basswood	---	---	
						Yellow birch	60	38	
						Eastern hemlock	---	---	
						Balsam fir	---	---	
						Quaking aspen	---	---	
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Black cherry	---	---	
						White spruce	---	---	
152B Kallio	3W	Slight	Moderate	Moderate	Severe	Sugar maple	62	39	Eastern white pine, white spruce.
						Yellow birch	---	---	
						Quaking aspen	---	---	
						Eastern hemlock	---	---	
						Balsam fir	---	---	
						Red maple	---	---	
						American basswood	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
153B**, 153D**:									
Champion-------	3X	Slight	Severe	Slight	Moderate	Sugar maple---------	60	38	White spruce, eastern white pine.
						American basswood---	---	---	
						Yellow birch--------	60	38	
						Eastern hemlock-----	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						Red maple-----------	---	---	
						Bigtooth aspen------	---	---	
						Black cherry--------	---	---	
						White spruce--------	---	---	
Karlin---------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	Red pine, eastern white pine.
						Yellow birch--------	---	---	
						Bigtooth aspen------	---	---	
						Northern red oak----	---	---	
						American basswood---	---	---	
						Red pine------------	65	---	
						Eastern white pine--	---	---	
Fence----------	3L	Slight	Severe	Slight	Slight	Sugar maple---------	65	40	Red pine, eastern white pine, white spruce.
						Yellow birch--------	---	---	
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
153E**:									
Champion-------	3R	Moderate	Moderate	Slight	Moderate	Sugar maple---------	60	38	Eastern white pine, white spruce.
						Yellow birch--------	60	38	
						Quaking aspen-------	---	---	
						Red maple-----------	---	---	
						Balsam fir----------	---	---	
						Bigtooth aspen------	---	---	
						Black cherry--------	---	---	
						White spruce--------	---	---	
						Eastern hemlock-----	---	---	
						American basswood---	---	---	
Karlin---------	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	61	38	Red pine, eastern white pine.
						Yellow birch--------	---	---	
						Bigtooth aspen------	---	---	
						Northern red oak----	---	---	
						American basswood---	---	---	
						Red pine------------	65	117	
						Eastern white pine--	---	---	
Fence----------	3R	Moderate	Severe	Slight	Slight	Sugar maple---------	65	40	Red pine, eastern white pine, white spruce.
						Yellow birch--------	---	---	
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
154B**:									
Vilas----------	6A	Slight	Slight	Slight	Slight	Red pine------------	57	93	Red pine, eastern white pine, jack pine.
						Jack pine-----------	65	94	
						Eastern white pine--	56	109	
						Northern pin oak----	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
Rubicon--------	4S	Slight	Moderate	Moderate	Slight	Quaking aspen-------	60	64	Red pine, jack pine.
						Jack pine-----------	53	73	
						Red pine------------	53	82	
						Bigtooth aspen------	66	75	
						Northern red oak----	---	---	
						Red maple-----------	57	36	
						Paper birch---------	---	---	
						Eastern white pine--	45	75	
154E**:									
Vilas----------	6R	Moderate	Moderate	Slight	Slight	Red pine------------	57	93	Red pine, eastern white pine, jack pine.
						Jack pine-----------	65	94	
						Eastern white pine--	56	109	
						Northern pin oak----	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
Rubicon--------	4R	Moderate	Moderate	Moderate	Slight	Quaking aspen-------	60	64	Red pine, jack pine.
						Jack pine-----------	53	73	
						Red pine------------	53	82	
						Bigtooth aspen------	66	75	
						Northern red oak----	---	---	
						Red maple-----------	57	36	
						Paper birch---------	---	---	
						Eastern white pine--	45	75	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked, unmanaged stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND

(Only the soils suitable for production of commercial trees are listed. Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
10B Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
10D Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: slope.	Slight.
10E Munising	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
11A Skanee	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
12 Gay	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Slight	Slight	Slight.
14A Assinins	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
15B Kalkaska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
15D Kalkaska	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
15E Kalkaska	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
16B Rubicon	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
16D Rubicon	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
17A Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
18A: Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
21B*:							
Keweenaw	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
Kalkaska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
21D*:							
Keweenaw	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
Kalkaska	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
22B*:							
Abbaye	Moderate: low strength.	Moderate: low strength, depth to rock.	Moderate: low strength, depth to rock.	Summer, fall, winter.	Slight	Moderate: depth to rock.	Moderate: depth to rock.
Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
23A*:							
Zeba	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: depth to rock.	Moderate: depth to rock.
Jacobsville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: depth to rock.	Slight.
24B: Deerton	Moderate: too sandy.	Moderate: too sandy, depth to rock.	Moderate: too sandy, depth to rock.	Spring, fall, winter.	Slight	Moderate: depth to rock.	Moderate: depth to rock.
25*:							
Lupton	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Cathro	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
26*:							
Dawson	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Loxley	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
29B Waiska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
30B*:							
Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
Skanee	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
31A*:							
Skanee	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
Gay	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Slight	Slight	Slight.
32B Alcona	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
33B*:							
Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
Yalmer	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
33D*:							
Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
33D*:							
Yalmer	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
34B Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: slope.	Slight.
34D Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Moderate: slope.	Severe: slope.	Moderate: slope.
34E Munising	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
35B Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
35D Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
35E Graveraet	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate. slope.
36A Sturgeon	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
37 Arnheim	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Slight	Slight	Slight.
38A Pelkie	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
41A Misery	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
46B*:							
Karlin	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
Kalkaska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
46D*:							
Karlin	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
Kalkaska	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
47B*:							
Ocqueoc	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Halfaday	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
51A*:							
Allendale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Rudyard	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
52B Allouez	Slight	Moderate: too cobbly.	Moderate: too cobbly.	Year round	Slight	Moderate: too cobbly.	Moderate: too cobbly.
56 Jacobsville	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: depth to rock.	Moderate: depth to rock.
58B*:							
Manistee	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Ontonagon	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
59B*:							
Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Ocqueoc	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Kalkaska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
60B*:							
Nunica	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
Fence	Severe: low strength.	Severe: slope, low strength.	Severe: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
60D*:							
Nunica	Moderate: low strength, slope.	Severe: slope.	Moderate: low strength, slope.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Fence	Severe: low strength.	Severe: slope, low strength.	Severe: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
60E*:							
Nunica	Severe: slope.	Severe: slope.	Severe: slope.	Summer, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Fence	Severe: slope, low strength.	Severe: slope, low strength.	Severe: slope, low strength.	Summer, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
61B Ontonagon	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
61D Ontonagon	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
61E Ontonagon	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
65A Rudyard	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
66B*:							
Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
66B*:							
Abbaye	Moderate: low strength.	Moderate: low strength, depth to rock, slope.	Moderate: low strength, depth to rock.	Summer, fall, winter.	Slight	Moderate: depth to rock, slope.	Moderate: depth to rock.
Kalkaska	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
66D*:							
Munising	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
Abbaye	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, depth to rock, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope, depth to rock.
Kalkaska	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
66F*:							
Munising	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Abbaye	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
67 Roscommon	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
69B*:							
Watton	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
Alstad	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
70B Watton	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
71A Richter	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
72A Halfaday	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight	Slight	Slight.
73B*:							
Froberg	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
Rudyard	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
75A*:							
Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight	Slight	Slight.
Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
76A*:							
Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Kinross	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
77*:							
Tawas	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Roscommon	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
78B Deer Park	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight	Slight	Slight.
79B*:							
Yalmer	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Assinins	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
84B: Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
84D: Graveraet	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
84E: Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
86B: Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
86D: Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
86E: Trimountain	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
89B*:							
Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Paavola	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
89D*: Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
Paavola	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
89E*:							
Trimountain	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
Paavola	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
90: Witbeck	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength, too cobbly.
92B*:							
Arcadian	Moderate: low strength, rock outcrop.	Severe: depth to rock.	Severe: depth to rock.	Summer, fall, winter.	Moderate: rock outcrop.	Severe: depth to rock.	Slight: depth to rock.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
92B*:							
Michigamme	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Moderate: rock outcrop.	Moderate: rock outcrop.	Moderate: depth to rock, rock outcrop, too cobbly.
Rock outcrop.							
92D*:							
Arcadian	Moderate: low strength, rock outcrop.	Severe: depth to rock.	Severe: depth to rock.	Summer, fall, winter.	Moderate: rock outcrop.	Severe: depth to rock.	Severe: depth to rock.
Michigamme	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Moderate: rock outcrop, too cobbly.	Moderate: slope, depth to rock, rock outcrop.	Moderate: slope, depth to rock, rock outcrop.
Rock outcrop.							
92E*:							
Arcadian	Moderate: slope, low strength, rock outcrop.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Summer, fall, winter.	Moderate: slope, rock outcrop.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Michigamme	Moderate: slope, rock outcrop.	Severe: slope.	Moderate: slope, rock outcrop, too cobbly.	Year round	Moderate: slope, rock outcrop.	Severe: slope.	Moderate: slope, rock outcrop, too cobbly.
Rock outcrop.							
95A*:							
Assinins	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
Skanee	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
96B Liminga	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
96D Liminga	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
96E---------------- Liminga	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
96F---------------- Liminga	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
98B*:							
Munising----------	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight----------	Moderate: slope.	Slight.
Yalmer------------	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight----------	Moderate: slope.	Slight.
98D:*							
Munising----------	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Yalmer------------	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
98E*:							
Munising----------	Severe: slope.	Severe: slope.	Severe: slope.	Summer, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Yalmer------------	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
100A*:							
Au Gres-----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight----------	Slight----------	Slight.
Roscommon---------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
101A--------------- Net	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight----------	Moderate: too cobbly.	Moderate: too cobbly.
102A*:							
Net---------------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight----------	Moderate: too cobbly.	Moderate: too cobbly.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
102A*:							
Witbeck	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength, too cobbly.
103B*:							
Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Net	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: too cobbly.	Moderate: too cobbly.
107B*:							
Kalkaska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Waiska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
107D*:							
Kalkaska	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Waiska	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
107E*:							
Kalkaska	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Waiska	Moderate: slope, too sandy.	Severe: slope.	Severe: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
108B Freda	Moderate: low strength.	Severe: depth to rock.	Moderate: low strength.	Summer, fall, winter.	Slight	Severe: depth to rock.	Slight.
110D*:							
Kalkaska	Moderate: slope, too sandy.	Severe: slope, too sandy.	Moderate: slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
110D*:							
Waiska	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
110E*:							
Kalkaska	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Waiska	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
115B*:							
Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
Paavola	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
115D*:							
Trimountain	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
Paavola	Moderate: slope.	Severe: slope.	Moderate: slope, too cobbly.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope, too cobbly.
115E*:							
Trimountain	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
116B*:							
Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
Paavola	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
Michigamme	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: depth to rock, slope.	Moderate: depth to rock.
116D*:							
Trimountain	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
116D*:							
Paavola	Moderate: slope.	Severe: slope.	Moderate: slope, too cobbly.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope, too cobbly.
Michigamme	Moderate: slope.	Severe: slope.	Moderate: slope, depth to rock.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope, depth to rock.
116E*:							
Trimountain	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Michigamme	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
119A*:							
Net	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: too cobbly.	Moderate: too cobbly.
Witbeck	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength, too cobbly.
125*:							
Kinross	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Dawson	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
127B*:							
Keweenaw	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
Kalkaska	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
127D*:							
Keweenaw	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
127D*:							
Kalkaska	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
127E*:							
Keweenaw	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
130B*:							
Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: slope.	Slight.
Alcona	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
Liminga	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
130D*:							
Munising	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Alcona	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Liminga	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
130F*:							
Munising	Severe: slope.	Severe: slope.	Severe: slope.	Summer, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Alcona	Severe: slope.	Severe: slope.	Severe: slope.	Summer, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Liminga	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
131B*:							
Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Misery	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
132B*:							
Kalkaska	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Alcona	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
132D*:							
Kalkaska	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Alcona	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
132F*:							
Kalkaska	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Alcona	Severe: slope.	Severe: slope.	Severe: slope.	Summer, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
133B*:							
Liminga	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Alcona	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
133D*:							
Liminga	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
133D*:							
Alcona	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
133E*:							
Liminga	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Alcona	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
134A*:							
Halfaday	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
135D*:							
Deer Park	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Kinross	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
136B*:							
Michigamme	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: depth to rock, too cobbly.	Moderate: depth to rock, too cobbly.
Net	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: too cobbly.	Moderate: too cobbly.
137A*:							
Sturgeon	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
Arnheim	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
137A*:							
Pelkie	Slight	Moderate: flooding.	Moderate: flooding.	Summer, winter	Slight	Slight	Slight.
138 Bergland	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
139B*:							
Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Paavola	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Waiska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
139D*:							
Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
Paavola	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
Waiska	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
139E*:							
Trimountain	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
Paavola	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
Waiska	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
140B*:							
Trimountain	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.
Paavola	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
140B*:							
Waiska	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
140D*:							
Trimountain	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
Paavola	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
Waiska	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
140E*:							
Trimountain	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Waiska	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
142F*:							
Keweenaw	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Waiska	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
144F*:							
Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
145B*:							
Kalkaska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall winter.	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
145B*:							
Halfaday	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall winter.	Slight	Slight	Slight.
146*:							
Cathro	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Gay	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Slight	Slight	Slight.
147B*:							
Munising	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
Liminga	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Alcona	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
148B*:							
Graveraet	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Moderate: slope.	Slight.
Ocqueoc	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Kalkaska	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
148D*:							
Graveraet	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
Ocqueoc	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
148D*:							
Kalkaska	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
150B*:							
Richter	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
Alcona	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
151B Champion	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: too cobbly.	Moderate: too cobbly.
152B Kallio	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
153B*:							
Champion	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: too cobbly.	Moderate: too cobbly.
Karlin	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Fence	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
153D*:							
Champion	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Moderate: slope, too cobbly.	Moderate: too cobbly.
Karlin	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Fence	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
153E*:							
Champion	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
153E*:							
Karlin	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Fence	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
154B*:							
Vilas	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Rubicon	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
154E*:							
Vilas	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Rubicon	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
10B------------------- Munising	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
10D------------------- Munising	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.
10E------------------- Munising	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
11A------------------- Skanee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
12-------------------- Gay	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
14A------------------- Assinins	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
15B------------------- Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
15D------------------- Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
15E------------------- Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
16B------------------- Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
16D------------------- Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
17A------------------- Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
18A------------------- Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
21B*:				
Keweenaw-------------	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
Kalkaska-------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
21D*:				
Keweenaw	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
22B*:				
Abbaye	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Munising	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
23A*:				
Zeba	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Jacobsville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
24B Deerton	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
25*:				
Lupton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Cathro	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
26*:				
Dawson	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Loxley	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.
27*:				
Histosols.				
Aquents.				
29B Waiska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
30B*:				
Munising	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
Skanee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
31A*:				
Skanee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Gay	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
32B Alcona	Slight	Slight	Moderate: slope.	Slight.
33B*:				
Munising	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
Yalmer	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
33D*:				
Munising	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.
Yalmer	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
34B Munising	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.
34D Munising	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
34E Munising	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
35B Graveraet	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.
35D Graveraet	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.
35E Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
36A Sturgeon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
37 Arnheim	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
38A Pelkie	Severe: flooding.	Slight	Moderate: flooding.	Slight.
41A Misery	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
45*. Pits, borrow				
46B*:				
Karlin	Slight	Slight	Moderate: slope, small stones.	Slight.
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
46D*:				
Karlin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
47B*:				
Ocqueoc	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Halfaday	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
51A*:				
Allendale	Severe: wetness, percs slowly, too sandy.	Severe: too sandy, percs slowly.	Severe: too sandy, wetness, percs slowly.	Severe: too sandy.
Rudyard	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
52B Allouez	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
55*. Dumps, mine				
56 Jacobsville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
58B*:				
Manistee	Severe: percs slowly, too sandy.	Severe: too sandy, percs slowly.	Severe: too sandy, percs slowly.	Severe: too sandy.
Ontonagon	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
59B*:				
Graveraet	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.
Ocqueoc	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
60B*:				
Nunica	Slight	Slight	Severe: slope.	Slight.
Fence	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight.
60D*:				
Nunica	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
Fence	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
60E*:				
Nunica	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
Fence	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
61B Ontonagon	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
61D Ontonagon	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.
61E Ontonagon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65A Rudyard	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
66B*:				
Munising	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.
Abbaye	Severe: wetness.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
66D*:				
Munising	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Abbaye	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
66F*:				
Munising	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Abbaye	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
67 Roscommon	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Severe: ponding.
68*. Dumps, stamp sand				
69B*:				
Watton	Slight	Slight	Moderate: slope.	Slight.
Alstad	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
70B Watton	Slight	Slight	Moderate: slope.	Slight.
71A Richter	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
72A Halfaday	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
73B*:				
Froberg	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
Rudyard	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
75A*:				
Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
76A*:				
Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
Kinross	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
77*:				
Tawas	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Roscommon	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Severe: ponding.
78B Deer Park	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
79B*:				
Yalmer	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Assinins	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
83*:				
Udipsamments.				
Udorthents.				
84B Graveraet	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.
84D Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
84E Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
86B Trimountain	Severe: wetness.	Moderate: wetness, large stones.	Severe: wetness.	Moderate: wetness.
86D Trimountain	Severe: wetness.	Moderate: slope, wetness, large stones.	Severe: slope, wetness.	Moderate: wetness.
86E Trimountain	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
89B*:				
Trimountain	Severe: wetness.	Moderate: wetness, large stones.	Severe: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
89B*:				
Paavola	Severe: small stones, wetness.	Moderate: wetness.	Severe: small stones, wetness.	Moderate: wetness.
89D*:				
Trimountain	Severe: wetness.	Moderate: slope, wetness, large stones.	Severe: slope, wetness.	Moderate: wetness.
Paavola	Severe: small stones, wetness.	Moderate: slope, wetness.	Severe: slope, small stones, wetness.	Moderate: wetness.
89E*:				
Trimountain	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
90 Witbeck	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: large stones, excess humus, ponding.	Severe: large stones, ponding, excess humus.
92B*:				
Arcadian	Severe: large stones, small stones.	Severe: large stones, small stones.	Severe: large stones, small stones.	Severe: large stones, small stones.
Michigamme	Severe: wetness.	Moderate: wetness, large stones.	Severe: large stones, wetness.	Moderate: large stones, wetness.
Rock outcrop.				
92D*:				
Arcadian	Severe: large stones, small stones.	Severe: large stones, small stones.	Severe: large stones, slope, small stones.	Severe: large stones, small stones.
Michigamme	Severe: wetness.	Moderate: slope, wetness, large stones.	Severe: large stones, slope, wetness.	Moderate: large stones, wetness.
Rock outcrop.				
92E*:				
Arcadian	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope, small stones.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
92E*:				
Michigamme-----------	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: slope.
Rock outcrop.				
95A*:				
Assinins-------------	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
Skanee---------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
96B------------------ Liminga	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
96D------------------ Liminga	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
96E, 96F------------- Liminga	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
98B*:				
Munising-------------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.
Yalmer---------------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
98D*:				
Munising-------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Yalmer---------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
98E*:				
Munising-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Yalmer---------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
100A*:				
Au Gres--------------	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
Roscommon------------	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
101A: Net	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
102A*:				
Net	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Witbeck	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: large stones, excess humus, ponding.	Severe: large stones, ponding, excess humus.
103B*:				
Trimountain	Severe: wetness.	Moderate: wetness, large stones.	Severe: wetness.	Moderate: wetness.
Net	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
104D*:				
Urban land.				
Udorthents.				
106B*, 106D*, 106E*:				
Urban land.				
Udorthents.				
Udipsamments.				
107B*:				
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Waiska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
107D*:				
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Waiska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
107E*:				
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Waiska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
108B: Freda	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
110D*:				
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Waiska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
110E*:				
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Waiska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
115B*:				
Trimountain	Severe: wetness.	Moderate: wetness, large stones.	Severe: slope, wetness.	Moderate: wetness.
Paavola	Severe: small stones, wetness.	Moderate: wetness.	Severe: slope, small stones, wetness.	Moderate: wetness.
115D*:				
Trimountain	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Paavola	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Moderate.
115E*:				
Trimountain	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
116B*:				
Trimountain	Severe: wetness.	Moderate: wetness, large stones.	Severe: slope, wetness.	Moderate: wetness.
Paavola	Severe: small stones, wetness.	Moderate: wetness.	Severe: slope, small stones, wetness.	Moderate: wetness.
Michigamme	Severe: wetness.	Moderate: wetness, large stones.	Severe: large stones, slope, wetness.	Moderate: large stones, wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
116D*:				
Trimountain----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Paavola--------------	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Moderate.
Michigamme-----------	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: large stones, slope.
116E*:				
Trimountain----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola--------------	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Michigamme-----------	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: slope.
119A*:				
Net------------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Witbeck--------------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: large stones, excess humus, ponding.	Severe: large stones, ponding, excess humus.
125*:				
Kinross--------------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Dawson---------------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
127B*:				
Keweenaw-------------	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight.
Kalkaska-------------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
127D*:				
Keweenaw-------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
Kalkaska-------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
127E*:				
Keweenaw	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
130B*:				
Munising	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.
Alcona	Slight	Slight	Severe: slope.	Slight.
Liminga	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
130D*:				
Munising	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Alcona	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Liminga	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
130F*:				
Munising	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Alcona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Liminga	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
131B*:				
Graveraet	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.
Misery	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
132B*:				
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Alcona	Slight	Slight	Severe: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
132D*:				
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Alcona	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
132F*:				
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Alcona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
133B*:				
Liminga	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Alcona	Slight	Slight	Moderate: slope.	Slight.
133D*:				
Liminga	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Alcona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
133E*:				
Liminga	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Alcona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
134A*:				
Halfaday	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
135D*:				
Deer Park	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Kinross	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
136B*:				
Michigamme	Severe: wetness.	Moderate: wetness, large stones.	Severe: large stones, wetness.	Moderate: large stones, wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
136B*:				
Net	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
137A*:				
Sturgeon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Arnheim	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
Pelkie	Severe: flooding.	Slight	Moderate: flooding.	Slight.
138 Bergland	Severe: ponding, percs slowly, too clayey.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.
139B*:				
Trimountain	Severe: wetness.	Moderate: wetness, large stones.	Severe: wetness.	Moderate: wetness.
Paavola	Severe: small stones, wetness.	Moderate: wetness.	Severe: small stones, wetness.	Moderate: wetness.
Waiska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
139D*:				
Trimountain	Severe: wetness.	Moderate: slope, wetness, large stones.	Severe: slope, wetness.	Moderate: wetness.
Paavola	Severe: small stones, wetness.	Moderate: slope, wetness.	Severe: slope, small stones, wetness.	Moderate: wetness.
Waiska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
139E*:				
Trimountain	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Waiska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
140B*:				
Trimountain----------	Severe: wetness.	Moderate: wetness, large stones.	Severe: slope, wetness.	Moderate: wetness.
Paavola--------------	Severe: small stones, wetness.	Moderate: wetness.	Severe: slope, small stones, wetness.	Moderate: wetness.
Waiska---------------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
140D*:				
Trimountain----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Paavola--------------	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Moderate.
Waiska---------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
140E*:				
Trimountain----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola--------------	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Waiska---------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
142F*:				
Keweenaw-------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Kalkaska-------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Waiska---------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
144F*:				
Graveraet------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
Kalkaska-------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
145B*:				
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Halfaday	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
146*:				
Cathro	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Gay	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
147B*:				
Munising	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
Liminga	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Alcona	Slight	Slight	Moderate: slope.	Slight.
148B*:				
Graveraet	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.
Ocqueoc	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
148D*:				
Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
Ocqueoc	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
150B*:				
Richter	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Alcona	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
151B------------------ Champion	Severe: wetness.	Moderate: wetness, large stones.	Severe: large stones, wetness.	Moderate: large stones, wetness.
152B------------------ Kallio	Severe: wetness.	Severe: wetness.	Severe: large stones, wetness.	Severe: wetness.
153B*:				
Champion-------------	Severe: wetness.	Moderate: wetness, large stones.	Severe: large stones, wetness.	Moderate: large stones, wetness.
Karlin---------------	Slight---------------	Slight---------------	Moderate: slope, small stones.	Slight.
Fence----------------	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight.
153D*:				
Champion-------------	Severe: wetness.	Moderate: slope, wetness, large stones.	Severe: large stones, slope, wetness.	Moderate: large stones, wetness.
Karlin---------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Fence----------------	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.
153E*:				
Champion-------------	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: slope.
Karlin---------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fence----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
154B*:				
Vilas----------------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
Rubicon--------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
154E*:				
Vilas----------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
154E*:				
Rubicon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
10B---------------- Munising	Good	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
10D---------------- Munising	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
10E---------------- Munising	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
11A---------------- Skanee	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
12----------------- Gay	Poor	Poor	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
14A---------------- Assinins	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
15B---------------- Kalkaska	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
15D---------------- Kalkaska	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
15E---------------- Kalkaska	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
16B---------------- Rubicon	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
16D---------------- Rubicon	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
17A---------------- Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
18A---------------- Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
21B*:										
Keweenaw----------	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Kalkaska----------	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
21D*:										
Keweenaw----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kalkaska----------	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
22B*:										
Abbaye------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
22B*:										
Munising	Good	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
23A*:										
Zeba	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
Jacobsville	Poor	Fair	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair.
24B Deerton	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
25*:										
Lupton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Cathro	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
26*:										
Dawson	Very poor.	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
Loxley	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
27*:										
Histosols.										
Aquents.										
29B Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
30B*:										
Munising	Good	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
Skanee	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
31A*:										
Skanee	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
Gay	Poor	Poor	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
32B Alcona	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
33B*:										
Munising	Good	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
Yalmer	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
33D*:										
Munising	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Yalmer	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
34B Munising	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
34D Munising	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
34E Munising	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
35B Graveraet	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
35D Graveraet	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
35E Graveraet	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
36A Sturgeon	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
37 Arnheim	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
38A Pelkie	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
41A Misery	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
45*. Pits, borrow										
46B*:										
Karlin	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kalkaska	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
46D*:										
Karlin	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kalkaska	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
47B*:										
Ocqueoc	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Halfaday	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
51A*:										
Allendale	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor.
Rudyard	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
52B Alllouez	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
55*. Dumps, mine										
56----------------- Jacobsville	Poor	Fair	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair.
58B*:										
Manistee----------	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Ontonagon---------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
59B*:										
Graveraet---------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ocqueoc-----------	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Kalkaska----------	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
60B*:										
Nunica------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Fence-------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
60D*:										
Nunica------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fence-------------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
60E*:										
Nunica------------	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fence-------------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
61B---------------- Ontonagon	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
61D---------------- Ontonagon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
61E---------------- Ontonagon	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
65A---------------- Rudyard	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
66B*:										
Munising----------	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
66B*:										
Abbaye	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Kalkaska	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
66D*:										
Munising	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Abbaye	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kalkaska	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
66F*:										
Munising	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Abbaye	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Kalkaska	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
67 Roscommon	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
68*. Dumps, stamp sand										
69B*:										
Watton	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Alstad	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
70B Watton	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
71A Richter	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
72A Halfaday	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
73B*:										
Froberg	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Fair	Very poor.
Rudyard	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
75A*:										
Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
76A*:										
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
Kinross	Very poor.	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Fair	Good.
77*:										
Tawas	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Roscommon	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
78B Deer Park	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
79B*:										
Yalmer	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Assinins	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
83*:										
Udipsamments.										
Udorthents.										
84B Graveraet	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
84D Graveraet	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
84E Graveraet	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
86B Trimountain	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
86D Trimountain	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
86E Trimountain	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
89B*:										
Trimountain	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Paavola	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
89D*:										
Trimountain	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Paavola	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
89E*:										
Trimountain	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
89E*:										
Paavola	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
90 Witbeck	Very poor.	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
92B*, 92D*:										
Arcadian	Poor	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.
Michigamme	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rock outcrop.										
92E*:										
Arcadian	Very poor.	Poor	Fair	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Michigamme	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.										
95A*:										
Assinins	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
Skanee	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
96B Liminga	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
96D Liminga	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
96E Liminga	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
96F Liminga	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
98B*:										
Munising	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Yalmer	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
98D*:										
Munising	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Yalmer	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
98E*:										
Munising	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
98E*:										
Yalmer	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
100A*:										
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
Roscommon	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
101A Net	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
102A*:										
Net	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Witbeck	Very poor.	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
103B*:										
Trimountain	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Net	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
104D*:										
Urban land.										
Udorthents.										
106B*, 106D*, 106E*:										
Urban land.										
Udorthents.										
Udipsamments.										
107B*:										
Kalkaska	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
107D*:										
Kalkaska	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
107E*:										
Kalkaska	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
108B Freda	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
110D*:										
Kalkaska	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
110E*:										
Kalkaska	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
115B*:										
Trimountain	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Paavola	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
115D*:										
Trimountain	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Paavola	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
115E*:										
Trimountain	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Paavola	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
116B*:										
Trimountain	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Paavola	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Michigamme	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
116D*:										
Trimountain	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Paavola	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Michigamme	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
116E*:										
Trimountain	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
116E*:										
Paavola	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Michigamme	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
119A*:										
Net	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Witbeck	Very poor.	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
125*:										
Kinross	Very poor.	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Fair	Good.
Dawson	Very poor.	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
127B*:										
Keweenaw	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kalkaska	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
127D*:										
Keweenaw	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kalkaska	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
127E*:										
Keweenaw	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Kalkaska	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
130B*:										
Munising	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Alcona	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Liminga	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
130D*:										
Munising	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alcona	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Liminga	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
130F*:										
Munising	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Alcona	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Liminga	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
131B*:										
Graveraet	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Misery	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
132B*:										
Kalkaska	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alcona	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
132D*:										
Kalkaska	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Alcona	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
132F*:										
Kalkaska	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Alcona	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
133B*:										
Liminga	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alcona	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
133D*:										
Liminga	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alcona	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
133E*:										
Liminga	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alcona	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
134A*:										
Halfaday	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
135D*:										
Deer Park	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Kinross	Very poor.	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Fair	Good.
136B*:										
Michigamme	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Net	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
137A*:										
Sturgeon	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Arnheim	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
Pelkie	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
138 Bergland	Poor	Poor	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
139B*:										
Trimountain	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Paavola	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
139D*:										
Trimountain	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Paavola	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
139E*:										
Trimountain	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Paavola	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
140B*:										
Trimountain	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Paavola	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
140D*:										
Trimountain	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Paavola	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
140E*:										
Trimountain	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Paavola	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
142F*:										
Keweenaw	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Kalkaska	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Waiska	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
144F*:										
Graveraet	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Kalkaska	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
145B*:										
Kalkaska	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Halfaday	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
146*:										
Cathro	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Gay	Poor	Poor	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
147B*:										
Munising	Good	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
Liminga	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alcona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
148B*:										
Graveraet	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ocqueoc	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kalkaska	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
148D*:										
Graveraet	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ocqueoc	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kalkaska	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
150B*:										
Richter	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Alcona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
151B Champion	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Good.
152B Kallio	Poor	Poor	Fair	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
153B*:										
Champion	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Good.
Karlin	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fence	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
153D*:										
Champion	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Karlin	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fence	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
153E*:										
Champion	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Karlin	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fence	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
154B*:										
Vilas	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Rubicon	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
154E*:										
Vilas	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rubicon	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
10B---------------- Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
10D---------------- Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Moderate: wetness, slope, frost action.	Moderate: wetness, droughty, slope.
10E---------------- Munising	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
11A---------------- Skanee	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
12----------------- Gay	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
14A---------------- Assinins	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
15B---------------- Kalkaska	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: droughty.
15D---------------- Kalkaska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
15E---------------- Kalkaska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
16B---------------- Rubicon	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: droughty.
16D---------------- Rubicon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
17A---------------- Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
18A---------------- Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
21B*: Keweenaw----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: small stones, large stones.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
21B*:						
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
21D*:						
Keweenaw	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, large stones, slope.
Kalkaska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
22B*:						
Abbaye	Severe: depth to rock, cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness.	Moderate: depth to rock, wetness.	Moderate: large stones, wetness, droughty.
Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
23A*:						
Zeba	Severe: depth to rock, cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Jacobsville	Severe: depth to rock, cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, depth to rock.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
24B Deerton	Severe: depth to rock, cutbanks cave.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Moderate: droughty, thin layer.
25*:						
Lupton	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
Cathro	Severe: excess humus, ponding.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
26*:						
Dawson	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Loxley	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: too acid, ponding, excess humus.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
27*:						
Histosols.						
Aquents.						
29B: Waiska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
30B*:						
Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Skanee	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
31A*:						
Skanee	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Gay	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
32B: Alcona	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
33B*:						
Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Yalmer	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Severe: droughty.
33D*:						
Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Moderate: wetness, slope, frost action.	Moderate: wetness, droughty, slope.
Yalmer	Severe: cutbanks cave, wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope.	Severe: droughty.
34B: Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
34D, 34E: Munising	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
35B: Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: large stones, wetness, droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
35D: Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Moderate: wetness, slope, frost action.	Moderate: large stones, wetness, droughty.
35E: Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
36A: Sturgeon	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness.
37: Arnheim	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
38A: Pelkie	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
41A: Misery	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
45*. Pits, borrow						
46B*: Karlin	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
46D*: Karlin	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Kalkaska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
47B*: Ocqueoc	Severe: cutbanks cave.	Slight	Moderate: wetness, shrink-swell.	Moderate: slope.	Slight	Moderate: droughty.
Halfaday	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Moderate: droughty, too sandy.
51A*: Allendale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty, too sandy.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
51A*:						
Rudyard----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: wetness.
52B--------------- Allouez	Severe: cutbanks cave.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: large stones.	Severe: droughty.
55*. Dumps, mine						
56---------------- Jacobsville	Severe: depth to rock, cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, depth to rock.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
58B*:						
Manistee---------	Severe: cutbanks cave.	Slight---------	Severe: shrink-swell.	Moderate: slope.	Slight---------	Moderate: droughty, too sandy.
Ontonagon--------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
59B*:						
Graveraet--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: large stones, wetness, droughty.
Ocqueoc----------	Severe: cutbanks cave.	Slight---------	Moderate: wetness, shrink-swell.	Moderate: slope.	Slight---------	Moderate: droughty.
Kalkaska---------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: droughty.
60B*:						
Nunica-----------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
Fence------------	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: frost action.	Slight.
60D*, 60E*:						
Nunica-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Fence------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
61B--------------- Ontonagon	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
61D--------------- Ontonagon	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
61E--------------- Ontonagon	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
65A--------------- Rudyard	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: wetness.
66B*:						
Munising----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Abbaye------------	Severe: depth to rock, cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness.	Moderate: depth to rock, wetness.	Moderate: large stones, wetness, droughty.
Kalkaska----------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Severe: droughty.
66D*, 66F*:						
Munising----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Abbaye------------	Severe: depth to rock, cutbanks cave, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
67---------------- Roscommon	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
68*. Dumps, stamp sand						
69B*:						
Watton------------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: large stones.
Alstad------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
70B--------------- Watton	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: large stones.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
71A: Richter	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
72A: Halfaday	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
73B*:						
Froberg	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Rudyard	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: wetness.
75A*:						
Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
76A*:						
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Kinross	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
77*:						
Tawas	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Roscommon	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
78B: Deer Park	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
79B*:						
Yalmer	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Severe: droughty.
Assinins	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
83*: Udipsamments.						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
83*: Udorthents.						
84B: Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: large stones, wetness, droughty.
84D, 84E: Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
86B: Trimountain	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
86D: Trimountain	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Moderate: wetness, slope, frost action.	Moderate: wetness, droughty.
86E: Trimountain	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
89B*: Trimountain	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Paavola	Severe: cutbanks cave, large stones, wetness.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: large stones.	Severe: droughty.
89D*: Trimountain	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Moderate: wetness, slope, frost action.	Moderate: wetness, droughty.
Paavola	Severe: cutbanks cave, large stones, wetness.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: wetness, slope, large stones.	Severe: large stones.	Severe: droughty.
89E*: Trimountain	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: droughty, slope.
90: Witbeck	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: large stones, ponding, excess humus.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
92B*:						
Arcadian	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: small stones, large stones.
Michigamme	Severe: depth to rock, cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness.	Moderate: depth to rock, wetness.	Severe: large stones.
Rock outcrop.						
92D*:						
Arcadian	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: small stones, large stones.
Michigamme	Severe: depth to rock, cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness, slope.	Moderate: depth to rock, wetness, slope.	Severe: large stones.
Rock outcrop.						
92E*:						
Arcadian	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: small stones, large stones, slope.
Michigamme	Severe: depth to rock, cutbanks cave, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
Rock outcrop.						
95A*:						
Assinins	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Skanee	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
96B Liminga	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
96D Liminga	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
96E, 96F Liminga	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
98B*:						
Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Yalmer	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Severe: droughty.
98D*, 98E*:						
Munising	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Yalmer	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
100A*:						
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Roscommon	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
101A Net	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: large stones, wetness, droughty.
102A*:						
Net	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: large stones, wetness, droughty.
Witbeck	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: large stones, ponding, excess humus.
103B*:						
Trimountain	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Net	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: large stones, wetness, droughty.
104D*:						
Urban land.						
Udorthents.						
106B*, 106D*, 106E*:						
Urban land.						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
106B*, 106D*, 106E*:						
Udorthents.						
Udipsamments.						
107B*:						
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
Waiska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
107D*:						
Kalkaska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Waiska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
107E*:						
Kalkaska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Waiska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
108B Freda	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer, area reclaim.
110D*, 110E*:						
Kalkaska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Waiska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
115B*:						
Trimountain	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Paavola	Severe: cutbanks cave, large stones, wetness.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: large stones.	Severe: droughty.
115D*, 115E*:						
Trimountain	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: droughty, slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
116B*:						
Trimountain------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Paavola----------	Severe: cutbanks cave, large stones, wetness.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: large stones.	Severe: droughty.
Michigamme-------	Severe: depth to rock, cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness.	Moderate: depth to rock, wetness.	Severe: large stones.
116D*, 116E*:						
Trimountain------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola----------	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: droughty, slope.
Michigamme-------	Severe: depth to rock, cutbanks cave, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
119A*:						
Net--------------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: large stones, wetness, droughty.
Witbeck----------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: large stones, ponding, excess humus.
125*:						
Kinross----------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
Dawson-----------	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
127B*:						
Keweenaw---------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: small stones, large stones.
Kalkaska---------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
127D*, 127E*:						
Keweenaw	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
130B*:						
Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Alcona	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
Liminga	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
130D*, 130F*:						
Munising	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Alcona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Liminga	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
131B*:						
Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: large stones, wetness, droughty.
Misery	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
132B*:						
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
Alcona	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
132D*, 132F*:						
Kalkaska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Alcona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
133B*:						
Liminga----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
Alcona-----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
133D*:						
Liminga----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Alcona-----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
133E*:						
Liminga----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Alcona-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
134A*:						
Halfaday---------	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
Au Gres----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
135D*:						
Deer Park--------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Kinross----------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
136B*:						
Michigamme-------	Severe: depth to rock, cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness.	Moderate: depth to rock, wetness.	Severe: large stones.
Net--------------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: large stones, wetness, droughty.
137A*:						
Sturgeon---------	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
137A*:						
Arnheim	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
Pelkie	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
138 Bergland	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
139B*:						
Trimountain	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Paavola	Severe: cutbanks cave, large stones, wetness.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: large stones.	Severe: droughty.
Waiska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
139D*:						
Trimountain	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Moderate: wetness, slope, frost action.	Moderate: wetness, droughty.
Paavola	Severe: cutbanks cave, large stones, wetness.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: wetness, slope, large stones.	Severe: large stones.	Severe: droughty.
Waiska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
139E*:						
Trimountain	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: droughty, slope.
Waiska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
140B*:						
Trimountain	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
140B*:						
Paavola	Severe: cutbanks cave, large stones, wetness.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: large stones.	Severe: droughty.
Waiska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
140D*, 140E*:						
Trimountain	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paavola	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: droughty, slope.
Waiska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
142F*:						
Keweenaw	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Waiska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
144F*:						
Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
145B*:						
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
Halfaday	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
146*:						
Cathro	Severe: excess humus, ponding.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
Gay	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
147B*:						
Munising	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Liminga	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Alcona	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
148B*:						
Graveraet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: large stones, wetness, droughty.
Ocqueoc	Severe: cutbanks cave.	Slight	Moderate: wetness, shrink-swell.	Moderate: slope.	Slight	Moderate: droughty.
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
148D*:						
Graveraet	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ocqueoc	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
150B*:						
Richter	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Alcona	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
151B Champion	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Severe: large stones.
152B Kallio	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: large stones, wetness.
153B*:						
Champion	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Severe: large stones.
Karlin	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
153B*:						
Fence	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: frost action.	Slight.
153D*:						
Champion	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Moderate: wetness, slope, frost action.	Severe: large stones.
Karlin	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Fence	Severe: wetness, cutbanks cave.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: frost action.	Moderate: slope.
153E*:						
Champion	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
Karlin	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fence	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
154B*:						
Vilas	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Rubicon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
154E*:						
Vilas	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10B----------------- Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
10D----------------- Munising	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
10E----------------- Munising	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: seepage, slope.
11A----------------- Skanee	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
12------------------ Gay	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
14A----------------- Assinins	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
15B----------------- Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
15D----------------- Kalkaska	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
15E----------------- Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
16B----------------- Rubicon	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
16D----------------- Rubicon	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
17A----------------- Croswell	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
18A----------------- Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
21B*:					
Keweenaw	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
21D*:					
Keweenaw	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
Kalkaska	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
22B*:					
Abbaye	Severe: thin layer, seepage, wetness.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage, wetness.	Severe: wetness.	Poor: area reclaim, wetness, thin layer.
Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
23A*:					
Zeba	Severe: thin layer, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Severe: seepage, wetness.	Poor: area reclaim, wetness.
Jacobsville	Severe: thin layer, seepage, ponding.	Severe: depth to rock, excess humus, ponding.	Severe: depth to rock, seepage, ponding.	Severe: seepage, ponding.	Poor: area reclaim, ponding, thin layer.
24B Deerton	Severe: thin layer, seepage.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, seepage, too sandy.
25*:					
Lupton	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Cathro	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
26*:					
Dawson	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
26*:					
Loxley	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
27*:					
Histosols.					
Aquents.					
29B Waiska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
30B*:					
Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
Skanee	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
31A*:					
Skanee	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Gay	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
32B Alcona	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
33B*:					
Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
Yalmer	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage.	Fair: too sandy, small stones.
33D*:					
Munising	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
Yalmer	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: wetness.	Severe: seepage.	Fair: too sandy, small stones, slope.
34B Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
34D, 34E: Munising	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: seepage, slope.
35B: Graveraet	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
35D: Graveraet	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
35E: Graveraet	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
36A: Sturgeon	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
37: Arnheim	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, too sandy.	Severe: flooding, wetness.	Poor: too sandy, wetness.
38A: Pelkie	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
41A: Misery	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.
45*. Pits, borrow					
46B*:					
Karlin	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
46D*:					
Karlin	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Kalkaska	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
47B*:					
Ocqueoc	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
47B*:					
Halfaday	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
51A*:					
Allendale	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
Rudyard	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
52B Allouez	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy, large stones.	Severe: seepage.	Poor: seepage, too sandy, small stones.
55*. Dumps, mine					
56 Jacobsville	Severe: thin layer, seepage, ponding.	Severe: depth to rock, excess humus, ponding.	Severe: depth to rock, seepage, ponding.	Severe: seepage, ponding.	Poor: area reclaim, ponding, thin layer.
58B*:					
Manistee	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
Ontonagon	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
59B*:					
Graveraet	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ocqueoc	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy.
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
60B*:					
Nunica	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
60B*:					
Fence	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
60D*, 60E*:					
Nunica	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Fence	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
61B Ontonagon	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
61D Ontonagon	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
61E Ontonagon	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
65A Rudyard	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
66B*:					
Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
Abbaye	Severe: thin layer, seepage, wetness.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage, wetness.	Severe: wetness.	Poor: area reclaim, wetness, thin layer.
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
66D*, 66F*:					
Munising	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: seepage, slope.
Abbaye	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
67 Roscommon	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
68*. Dumps, stamp sand					
69B*:					
Watton	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Alstad	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
70B Watton	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
71A Richter	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
72A Halfaday	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
73B*:					
Froberg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
Rudyard	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
75A*:					
Croswell	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
76A*:					
Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
76A*:					
Kinross	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
77*:					
Tawas	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Roscommon	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
78B Deer Park	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
79B*:					
Yalmer	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage.	Fair: too sandy, small stones.
Assinins	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
83*:					
Udipsamments.					
Udorthents.					
84B Graveraet	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
84D, 84E Graveraet	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
86B Trimountain	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
86D Trimountain	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
86E Trimountain	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: seepage, small stones, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
89B*:					
Trimountain	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
Paavola	Severe: wetness, percs slowly, large stones.	Severe: seepage, large stones.	Severe: seepage, wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
89D*:					
Trimountain	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
Paavola	Severe: wetness, percs slowly, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
89E*:					
Trimountain	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: seepage, small stones, slope.
Paavola	Severe: percs slowly, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: slope.	Poor: seepage, small stones, slope.
90 Witbeck	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: seepage, small stones, ponding.
92B*:					
Arcadian	Severe: thin layer, seepage, large stones.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: seepage, small stones.
Michigamme	Severe: thin layer, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Severe: seepage, wetness.	Poor: area reclaim, large stones, wetness.
Rock outcrop.					
92D*:					
Arcadian	Severe: thin layer, seepage, large stones.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: seepage, small stones.
Michigamme	Severe: thin layer, seepage, wetness.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, seepage, wetness.	Severe: seepage, wetness.	Poor: area reclaim, large stones, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
92D*:					
Rock outcrop.					
92E*:					
Arcadian	Severe: thin layer, seepage, large stones.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, slope, seepage.	Severe: seepage, slope.	Poor: area reclaim, small stones, slope.
Michigamme	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, large stones, slope.
Rock outcrop.					
95A*:					
Assinins	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Skanee	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
96B Liminga	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
96D Liminga	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
96E, 96F Liminga	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
98B*:					
Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
Yalmer	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage.	Fair: too sandy, small stones.
98D*, 98E*:					
Munising	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: seepage, slope.
Yalmer	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
100A*:					
Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
100A*:					
Roscommon	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
101A Net	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: small stones, wetness, seepage.
102A*:					
Net	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: small stones, wetness, seepage.
Witbeck	Severe: ponding, percs slowly.	Severe: excess humus, ponding, large stones.	Severe: ponding.	Severe: ponding.	Poor: small stones, ponding.
103B*:					
Trimountain	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
Net	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: small stones, wetness, seepage.
104D*:					
Urban land.					
Udorthents.					
106B*, 106D*, 106E*:					
Urban land.					
Udorthents.					
Udipsamments.					
107B*:					
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Waiska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
107D*:					
Kalkaska	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
107D*:					
Waiska	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
107E*:					
Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Waiska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
108B Freda	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
110D*, 110E*:					
Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Waiska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
115B*:					
Trimountain	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
Paavola	Severe: wetness, percs slowly, large stones.	Severe: seepage, large stones.	Severe: seepage, wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
115D*, 115E*:					
Trimountain	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: seepage, small stones, slope.
Paavola	Severe: percs slowly, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: slope.	Poor: seepage, small stones, slope.
116B*:					
Trimountain	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
116B*:					
Paavola	Severe: wetness, percs slowly, large stones.	Severe: seepage, large stones.	Severe: seepage, wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
Michigamme	Severe: thin layer, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Severe: seepage, wetness.	Poor: area reclaim, large stones, wetness.
116D*, 116E*:					
Trimountain	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: seepage, small stones, slope.
Paavola	Severe: percs slowly, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: slope.	Poor: seepage, small stones, slope.
Michigamme	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, large stones, slope.
119A*:					
Net	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: small stones, wetness, seepage.
Witbeck	Severe: ponding, percs slowly.	Severe: excess humus, ponding, large stones.	Severe: ponding.	Severe: ponding.	Poor: small stones, ponding.
125*:					
Kinross	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Dawson	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
127B*:					
Keweenaw	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
127D*, 127E*:					
Keweenaw	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
130B*:					
Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
Alcona	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
Liminga	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
130D*, 130F*:					
Munising	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: seepage, slope.
Alcona	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
Liminga	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
131B*:					
Graveraet	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Misery	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.
132B*:					
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alcona	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
132D*, 132F*:					
Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
132D*, 132F*:					
Alcona	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
133B*:					
Liminga	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Alcona	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
133D*:					
Liminga	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Alcona	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: too sandy.
133E*:					
Liminga	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
Alcona	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
134A*:					
Halfaday	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
135D*:					
Deer Park	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Kinross	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
136B*:					
Michigamme	Severe: thin layer, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Severe: seepage, wetness.	Poor: area reclaim, large stones, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
136B*:					
Net----------------	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: small stones, wetness, seepage.
137A*:					
Sturgeon-----------	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Arnheim------------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, too sandy.	Severe: flooding, wetness.	Poor: too sandy, wetness.
Pelkie-------------	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
138---------------- Bergland	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
139B*:					
Trimountain--------	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
Paavola------------	Severe: wetness, percs slowly, large stones.	Severe: seepage, large stones.	Severe: seepage, wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
Waiska-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
139D*:					
Trimountain--------	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
Paavola------------	Severe: wetness, percs slowly, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
Waiska-------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
139E*:					
Trimountain	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: seepage, small stones, slope.
Paavola	Severe: percs slowly, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: slope.	Poor: seepage, small stones, slope.
Waiska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
140B*:					
Trimountain	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
Paavola	Severe: wetness, percs slowly, large stones.	Severe: seepage, large stones.	Severe: seepage, wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
Waiska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
140D*, 140E*:					
Trimountain	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: seepage, small stones, slope.
Paavola	Severe: percs slowly, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: slope.	Poor: seepage, small stones, slope.
Waiska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
142F*:					
Keweenaw	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
142F*:					
Waiska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
144F*:					
Graveraet	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
145B*:					
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Halfaday	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
146*:					
Cathro	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
Gay	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
147B*:					
Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
Liminga	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Alcona	Severe: wetness.	Severe: seepage, wetness.	Severe: too sandy.	Moderate: wetness.	Poor: too sandy.
148B*:					
Graveraet	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ocqueoc	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
148B*:					
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
148D*:					
Graveraet	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ocqueoc	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
150B*:					
Richter	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
Alcona	Severe: wetness.	Severe: seepage, wetness.	Severe: too sandy.	Moderate: wetness.	Poor: too sandy.
151B Champion	Severe: wetness, percs slowly.	Severe: seepage, large stones.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
152B Kallio	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
153B*:					
Champion	Severe: wetness, percs slowly.	Severe: seepage, large stones.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
Karlin	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Fence	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
153D*:					
Champion	Severe: wetness, percs slowly.	Severe: seepage, slope, large stones.	Severe: seepage, wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
153D*:					
Karlin	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Fence	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope.	Moderate: wetness, slope.	Fair: slope, wetness.
153E*:					
Champion	Severe: percs slowly, slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Severe: slope.	Poor: seepage, small stones, slope.
Karlin	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Fence	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
154B*:					
Vilas	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Rubicon	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
154E*:					
Vilas	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Rubicon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
10B, 10D: Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim, too sandy, small stones.
10E: Munising	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
11A: Skanee	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
12: Gay	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
14A: Assinins	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
15B, 15D: Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
15E: Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
16B, 16D: Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
17A: Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
18A: Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
21B*, 21D*:				
Keweenaw	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
22B*:				
Abbaye	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim, too sandy, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
23A*:				
Zeba	Poor: area reclaim, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
Jacobsville	Poor: depth to rock, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
24B Deerton	Poor: depth to rock.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
25*:				
Lupton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
26*:				
Dawson	Poor: wetness.	Probable	Probable	Poor: excess humus, wetness.
Loxley	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness, too acid.
27*:				
Histosols.				
Aquents.				
29B Waiska	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
30B*:				
Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim, too sandy, small stones.
Skanee	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
31A*:				
Skanee	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
Gay	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
32B Alcona	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
33B*, 33D*:				
Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim, too sandy, small stones.
Yalmer	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
34B Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim, too sandy, small stones.
34D Munising	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
34E Munising	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
35B, 35D Graveraet	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
35E Graveraet	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
36A Sturgeon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
37 Arnheim	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
38A Pelkie	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
41A Misery	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
45*. Pits, borrow				
46B*:				
Karlin	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
46D*:				
Karlin	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones, slope.
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
47B*:				
Ocqueoc	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Halfaday	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
51A*:				
Allendale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Rudyard	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
52B Allouez	Fair: large stones.	Probable	Probable	Poor: small stones, area reclaim.
55*. Dumps, mine				
56 Jacobsville	Poor: depth to rock, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
58B*:				
Manistee	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Ontonagon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
59B*:				
Graveraet	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Ocqueoc	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
60B*:				
Nunica	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Fence	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
60D*:				
Nunica	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Fence	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
60E*:				
Nunica	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Fence	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
61B, 61D Ontonagon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
61E Ontonagon	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
65A Rudyard	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
66B*:				
Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim, too sandy, small stones.
Abbaye	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
66D*:				
Munising	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
Abbaye	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Kalkaska	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
66F*:				
Munising	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
Abbaye	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
67 Roscommon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
68*. Dumps, stamp sand				
69B*:				
Watton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: large stones.
Alstad	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
70B Watton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: large stones.
71A Richter	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
72A Halfaday	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
73B*:				
Froberg	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Rudyard	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
75A*:				
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
76A*:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
77*:				
Tawas	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Roscommon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
78B Deer Park	Good	Probable	Improbable: too sandy.	Poor: too sandy.
79B*:				
Yalmer	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
79B*:				
Assinins	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
83*:				
Udipsamments.				
Udorthents.				
84B Graveraet	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
84D Graveraet	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
84E Graveraet	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
86B, 86D Trimountain	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
86E Trimountain	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
89B*, 89D*:				
Trimountain	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
Paavola	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
89E*:				
Trimountain	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Paavola	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
90 Witbeck	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, area reclaim, wetness.
92B*, 92D*:				
Arcadian	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
92B*, 92D*:				
Michigamme	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
Rock outcrop.				
92E*:				
Arcadian	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones, slope.
Michigamme	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
Rock outcrop.				
95A*:				
Assinins	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
Skanee	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
96B, 96D Liminga	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
96E, 96F Liminga	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
98B*:				
Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim, too sandy, small stones.
Yalmer	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
98D*:				
Munising	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
Yalmer	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, slope.
98E*:				
Munising	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
Yalmer	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
100A*:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Roscommon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
101A Net	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, area reclaim, wetness.
102A*:				
Net	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, area reclaim, wetness.
Witbeck	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, large stones, area reclaim.
103B*:				
Trimountain	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
Net	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, area reclaim, wetness.
104D*:				
Urban land.				
Udorthents.				
106B*, 106D*, 106E*:				
Urban land.				
Udorthents.				
Udipsamments.				
107B*, 107D*:				
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Waiska	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
107E*:				
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
107E*:				
Waiska	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
108B Freda	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
110D*:				
Kalkaska	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Waiska	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
110E*:				
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Waiska	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
115B*:				
Trimountain	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
Paavola	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
115D*:				
Trimountain	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Paavola	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
115E*:				
Trimountain	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Paavola	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
116B*:				
Trimountain	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
Paavola	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
Michigamme	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
116D*:				
Trimountain	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Paavola	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
Michigamme	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
116E*:				
Trimountain	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Paavola	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
Michigamme	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
119A*:				
Net	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, area reclaim, wetness.
Witbeck	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, large stones, area reclaim.
125*:				
Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
125*:				
Dawson	Poor: wetness.	Probable	Probable	Poor: excess humus, wetness.
127B*:				
Keweenaw	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
127D*:				
Keweenaw	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
Kalkaska	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
127E*:				
Keweenaw	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
130B*:				
Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim, too sandy, small stones.
Alcona	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Liminga	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
130D*:				
Munising	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
Alcona	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
Liminga	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
130F*:				
Munising	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
130F*:				
Alcona	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
Liminga	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
131B*:				
Graveraet	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Misery	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
132B*:				
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Alcona	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
132D*:				
Kalkaska	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Alcona	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
132F*:				
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Alcona	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
133B*, 133D*:				
Liminga	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Alcona	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
133E*:				
Liminga	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
Alcona	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
134A*:				
Halfaday	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
134A*:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
135D*:				
Deer Park	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
136B*:				
Michigamme	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
Net	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, area reclaim, wetness.
137A*:				
Sturgeon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Arnheim	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
Pelkie	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
138 Bergland	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
139B*, 139D*:				
Trimountain	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
Paavola	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
Waiska	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
139E*:				
Trimountain	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
139E*:				
Paavola	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
Waiska	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
140B*:				
Trimountain	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
Paavola	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
Waiska	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
140D*:				
Trimountain	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Paavola	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
Waiska	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
140E*:				
Trimountain	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Paavola	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
Waiska	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
142F*:				
Keweenaw	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Waiska	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
144F*:				
Graveraet	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
145B*:				
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Halfaday	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
146*:				
Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Gay	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
147B*:				
Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim, too sandy, small stones.
Liminga	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Alcona	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
148B*:				
Graveraet	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Ocqueoc	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
148D*:				
Graveraet	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Ocqueoc	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
Kalkaska	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
150B*:				
Richter	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Alcona	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
151B Champion	Fair: large stones, wetness.	Probable	Improbable: too sandy.	Poor: large stones, area reclaim.
152B Kallio	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, wetness.
153B*:				
Champion	Fair: large stones, wetness.	Probable	Improbable: too sandy.	Poor: large stones, area reclaim.
Karlin	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
Fence	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
153D*:				
Champion	Fair: large stones, wetness.	Probable	Improbable: too sandy.	Poor: large stones, area reclaim.
Karlin	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones, slope.
Fence	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
153E*:				
Champion	Poor: slope.	Probable	Improbable: too sandy.	Poor: large stones, area reclaim, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
153E*:				
Karlin	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
Fence	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
154B*:				
Vilas	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
154E*:				
Vilas	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Rubicon	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
10B: Munising	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Wetness, droughty.
10D: Munising	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Slope, wetness, rooting depth.	Wetness, slope, droughty.
10E: Munising	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, rooting depth, too sandy.	Slope, droughty, rooting depth.
11A: Skanee	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, droughty.	Wetness, rooting depth, soil blowing.	Wetness, droughty, rooting depth.
12: Gay	Moderate: seepage.	Severe: ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding, soil blowing, rooting depth.	Ponding, soil blowing.	Wetness, rooting depth.
14A: Assinins	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action	Wetness, droughty, fast intake.	Wetness, soil blowing, erodes easily.	Wetness, droughty, erodes easily.
15B: Kalkaska	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
15D, 15E: Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
16B: Rubicon	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
16D: Rubicon	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
17A----------------- Croswell	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy.	Droughty.
18A----------------- Au Gres	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
21B*:							
Keweenaw----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Large stones, too sandy.	Large stones, droughty.
Kalkaska----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
21D*:							
Keweenaw----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Kalkaska----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
22B*:							
Abbaye------------	Moderate: seepage, depth to rock, slope.	Severe: piping.	Severe: no water.	Thin layer, slope.	Slope, wetness, droughty.	Depth to rock, area reclaim.	Wetness, droughty.
Munising----------	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Wetness, droughty.
23A*:							
Zeba--------------	Moderate: seepage, depth to rock.	Severe: seepage, piping, wetness.	Severe: depth to rock, cutbanks cave.	Thin layer, frost action, cutbanks cave.	Wetness, droughty.	Depth to rock, area reclaim, wetness.	Wetness, droughty, depth to rock.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
23A*:							
Jacobsville	Moderate: seepage, depth to rock.	Severe: piping, ponding.	Severe: depth to rock, cutbanks cave.	Ponding, thin layer, frost action.	Ponding, soil blowing, thin layer.	Large stones, depth to rock, ponding.	Large stones, wetness, depth to rock.
24B Deerton	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Depth to rock, too sandy.	Droughty, depth to rock.
25*:							
Lupton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Cathro	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
26*:							
Dawson	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, rooting depth.	Ponding	Wetness, rooting depth.
Loxley	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, too acid.	Ponding	Wetness.
27*:							
Histosols.							
Aquents.							
29B Waiska	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
30B*:							
Munising	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Wetness, droughty.
Skanee	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, droughty.	Wetness, rooting depth, soil blowing.	Wetness, droughty, rooting depth.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
31A*:							
Skanee	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, droughty.	Wetness, rooting depth, soil blowing.	Wetness, droughty, rooting depth.
Gay	Moderate: seepage.	Severe: ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding, soil blowing, rooting depth.	Ponding, soil blowing.	Wetness, rooting depth.
32B Alcona	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
33B*:							
Munising	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Wetness, droughty.
Yalmer	Severe: seepage.	Severe: piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Droughty, rooting depth.
33D*:							
Munising	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Slope, wetness, rooting depth.	Wetness, slope, droughty.
Yalmer	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Slope, wetness, rooting depth.	Slope, droughty, rooting depth.
34B Munising	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Wetness, droughty.
34D, 34E Munising	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, rooting depth, too sandy.	Slope, droughty, rooting depth.
35B Graveraet	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Wetness, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
35D---------------- Graveraet	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
35E---------------- Graveraet	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, erodes easily.	Slope, erodes easily, droughty.
36A---------------- Sturgeon	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
37----------------- Arnheim	Moderate: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, frost action, cutbanks cave.	Wetness, droughty.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, droughty.
38A---------------- Pelkie	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
41A---------------- Misery	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, droughty.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, droughty.
45*. Pits, borrow							
46B*:							
Karlin------------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty.
Kalkaska----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
46D*:							
Karlin------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
46D*:							
Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
47B*:							
Ocqueoc	Severe: seepage.	Severe: piping.	Severe: slow refill, cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Droughty.
Halfaday	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
51A*:							
Allendale	Severe: seepage.	Severe: hard to pack, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly	Wetness, droughty.	Wetness, soil blowing, percs slowly.	Wetness, droughty, percs slowly.
Rudyard	Slight	Severe: wetness, hard to pack.	Severe: no water.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
52B Allouez	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, too sandy.	Large stones, droughty.
55*. Dumps, mine							
56 Jacobsville	Moderate: seepage, depth to rock.	Severe: piping, ponding.	Severe: depth to rock, cutbanks cave.	Ponding, thin layer, frost action.	Ponding, soil blowing, thin layer.	Large stones, depth to rock, ponding.	Large stones, wetness, depth to rock.
58B*:							
Manistee	Severe: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Wetness, soil blowing, percs slowly.	Droughty, percs slowly.
Ontonagon	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
59B*:							
Graveraet	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Wetness, erodes easily.
Ocqueoc	Severe: seepage.	Severe: piping.	Severe: slow refill, cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Droughty.
Kalkaska	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
60B*:							
Nunica	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
Fence	Moderate: slope.	Severe: piping.	Severe: no water.	Frost action, slope.	Wetness, soil blowing, slope.	Erodes easily, wetness.	Erodes easily.
60D*, 60E*:							
Nunica	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Fence	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
61B Ontonagon	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
61D, 61E Ontonagon	Severe: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
65A Rudyard	Slight	Severe: wetness, hard to pack.	Severe: no water.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
66B*:							
Munising	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Wetness, droughty.
Abbaye	Moderate: seepage, depth to rock, slope.	Severe: piping.	Severe: no water.	Thin layer, slope.	Slope, wetness, droughty.	Depth to rock, area reclaim.	Wetness, droughty.
Kalkaska	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
66D*, 66F*:							
Munising	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, rooting depth, too sandy.	Slope, droughty, rooting depth.
Abbaye	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, depth to rock, area reclaim.	Slope, droughty, depth to rock.
Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
67 Roscommon	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy, soil blowing.	Wetness, droughty.
68*. Dumps, stamp sand							
69B*:							
Watton	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Rooting depth, slope, erodes easily.	Erodes easily	Erodes easily, rooting depth.
Alstad	Moderate: seepage.	Severe: thin layer.	Severe: no water.	Frost action	Wetness, erodes easily.	Wetness, erodes easily.	Wetness, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
70B---------------- Watton	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Rooting depth, slope, erodes easily.	Erodes easily	Erodes easily, rooting depth.
71A---------------- Richter	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing, erodes easily.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
72A---------------- Halfaday	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
73B*:							
Froberg-----------	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: slow refill.	Deep to water	Percs slowly, rooting depth, slope.	Erodes easily	Erodes easily, rooting depth, percs slowly.
Rudyard-----------	Slight---------	Severe: wetness, hard to pack.	Severe: no water.	Percs slowly---	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
75A*:							
Croswell----------	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy.	Droughty.
Au Gres-----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
76A*:							
Au Gres-----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Kinross-----------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding--------	Ponding, too sandy, soil blowing.	Wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
77*:							
Tawas	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
Roscommon	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy, soil blowing.	Wetness, droughty.
78B: Deer Park	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
79B*:							
Yalmer	Severe: seepage.	Severe: piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Droughty, rooting depth.
Assinins	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action	Wetness, droughty, fast intake.	Wetness, soil blowing, erodes easily.	Wetness, droughty, erodes easily.
83*:							
Udipsamments.							
Udorthents.							
84B: Graveraet	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Wetness, erodes easily.
84D, 84E: Graveraet	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, erodes easily.	Slope, erodes easily, droughty.
86B: Trimountain	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Large stones, wetness.	Large stones, wetness.
86D: Trimountain	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Slope, large stones, wetness.	Large stones, wetness, slope.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
86E----------------- Trimountain	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, rooting depth.	Large stones, slope, droughty.
89B*:							
Trimountain-------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Large stones, wetness.	Large stones, wetness.
Paavola-----------	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, large stones, slope.	Slope, large stones, wetness.	Large stones, wetness.	Large stones, wetness.
89D*:							
Trimountain-------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Slope, large stones, wetness.	Large stones, wetness, slope.
Paavola-----------	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, large stones, slope.	Slope, large stones, wetness.	Slope, large stones, wetness.	Large stones, wetness, slope.
89E*:							
Trimountain-------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, rooting depth.	Large stones, slope, droughty.
Paavola-----------	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, percs slowly.	Large stones, slope, droughty.
90----------------- Witbeck	Severe: seepage.	Severe: seepage, large stones, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Large stones, ponding, soil blowing.	Large stones, ponding, too sandy.	Large stones, wetness.
92B*:							
Arcadian----------	Severe: depth to rock, seepage.	Severe: seepage, piping, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
92B*:							
Michigamme	Moderate: seepage, depth to rock, slope.	Severe: piping, large stones.	Severe: no water.	Thin layer, large stones, slope.	Slope, large stones, wetness.	Large stones, depth to rock.	Large stones, wetness.
Rock outcrop.							
92D*:							
Arcadian	Severe: depth to rock, seepage, slope.	Severe: seepage, piping, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Michigamme	Severe: slope.	Severe: piping, large stones.	Severe: no water.	Thin layer, large stones, slope.	Slope, large stones, wetness.	Slope, large stones, depth to rock.	Large stones, wetness, slope.
Rock outcrop.							
92E*:							
Arcadian	Severe: depth to rock, seepage, slope.	Severe: seepage, piping, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Michigamme	Severe: slope.	Severe: piping, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.							
95A*:							
Assinins	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action	Wetness, droughty, fast intake.	Wetness, soil blowing, erodes easily.	Wetness, droughty, erodes easily.
Skanee	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, droughty.	Wetness, rooting depth, soil blowing.	Wetness, droughty, rooting depth.
96B Liminga	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
96D, 96E, 96F----- Liminga	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
98B*:							
Munising---------	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Wetness, droughty.
Yalmer-----------	Severe: seepage.	Severe: piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Droughty, rooting depth.
98D*, 98E*:							
Munising---------	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, rooting depth, too sandy.	Slope, droughty, rooting depth.
Yalmer-----------	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, rooting depth, soil blowing.	Slope, droughty, rooting depth.
100A*:							
Au Gres----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Roscommon--------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy, soil blowing.	Wetness, droughty.
101A-------------- Net	Severe: seepage.	Severe: seepage, wetness.	Severe: no water.	Percs slowly, frost action, cutbanks cave.	Large stones, wetness, droughty.	Large stones, wetness, rooting depth.	Large stones, wetness, droughty.
102A-------------- Net	Severe: seepage.	Severe: seepage, wetness.	Severe: no water.	Percs slowly, frost action, cutbanks cave.	Large stones, wetness, droughty.	Large stones, wetness, rooting depth.	Large stones, wetness, droughty.
Witbeck----------	Moderate: seepage.	Severe: piping, large stones,	Severe: slow refill.	Ponding, frost action.	Large stones, ponding, droughty.	Large stones, ponding.	Large stones, wetness, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
103B*:							
Trimountain	Severe: seepage.	Severe: seepage, wetness.	Severe: no water.	Percs slowly, frost action, cutbanks cave.	Large stones, wetness, droughty.	Large stones, wetness.	Large stones, wetness.
Net	Severe: seepage.	Severe: seepage, wetness.	Severe: no water.	Percs slowly, frost action, cutbanks cave.	Large stones, wetness, droughty.	Large stones, wetness, rooting depth.	Large stones, wetness, droughty.
104D*:							
Urban land.							
Udorthents.							
106B*, 106D*, 106E*:							
Urban land.							
Udorthents.							
Udipsamments.							
107B*:							
Kalkaska	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Waiska	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
107D*, 107E*:							
Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Waiska	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
108B: Freda	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, thin layer.	Depth to rock, area reclaim.	Depth to rock, area reclaim.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
110D*, 110E*:							
Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Waiska	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
115B*:							
Trimountain	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Large stones, wetness.	Large stones, wetness.
Paavola	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, large stones, slope.	Slope, large stones, wetness.	Large stones, wetness.	Large stones, wetness.
115D*, 115E*:							
Trimountain	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, rooting depth.	Large stones, slope, droughty.
Paavola	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, percs slowly.	Large stones, slope, droughty.
116B*:							
Trimountain	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Large stones, wetness.	Large stones, wetness.
Paavola	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, large stones, slope.	Slope, large stones, wetness.	Large stones, wetness.	Large stones, wetness.
Michigamme	Moderate: seepage, depth to rock, slope.	Severe: piping, large stones.	Severe: no water.	Thin layer, large stones, slope.	Slope, large stones, wetness.	Large stones, depth to rock.	Large stones, wetness.
116D*, 116E*:							
Trimountain	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, rooting depth.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
116D*, 116E*:							
Paavola----------	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, percs slowly.	Large stones, slope, droughty.
Michigamme-------	Severe: slope.	Severe: piping, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
119A*:							
Net--------------	Severe: seepage.	Severe: seepage, wetness.	Severe: no water.	Percs slowly, frost action, cutbanks cave.	Large stones, wetness, droughty.	Large stones, wetness, rooting depth.	Large stones, wetness, droughty.
Witbeck----------	Moderate: seepage.	Severe: piping, large stones, ponding.	Severe: slow refill.	Ponding, frost action.	Large stones, ponding, droughty.	Large stones, ponding.	Large stones, wetness, droughty.
125*:							
Kinross----------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding--------	Ponding, too sandy, soil blowing.	Wetness.
Dawson-----------	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, rooting depth.	Ponding--------	Wetness, rooting depth.
127B*:							
Keweenaw---------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Large stones, too sandy.	Large stones, droughty.
Kalkaska---------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
127D*, 127E*:							
Keweenaw---------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, too sandy.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
127D*, 127E*:							
Kalkaska----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
130B*:							
Munising----------	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Wetness, droughty.
Alcona------------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Liminga-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
130D*, 130F*:							
Munising----------	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, rooting depth, too sandy.	Slope, droughty, rooting depth.
Alcona------------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Liminga-----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
131B*:							
Graveraet---------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Wetness, erodes easily.
Misery------------	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, droughty.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, droughty.
132B*:							
Kalkaska----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
132B*:							
Alcona	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
132D*, 132F*:							
Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Alcona	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
133B*:							
Liminga	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Alcona	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
133D*, 133E*:							
Liminga	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Alcona	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
134A*:							
Halfaday	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
Au Gres	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
135D*:							
Deer Park	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Kinross	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding	Ponding, too sandy, soil blowing.	Wetness.
136B*:							
Michigamme	Moderate: seepage, depth to rock, slope.	Severe: piping, large stones.	Severe: no water.	Thin layer, large stones, slope.	Slope, large stones, wetness.	Large stones, depth to rock.	Large stones, wetness.
Net	Severe: seepage.	Severe: seepage, wetness.	Severe: no water.	Percs slowly, frost action, cutbanks cave.	Large stones, wetness, droughty.	Large stones, wetness, rooting depth.	Large stones, wetness, droughty.
137A*:							
Sturgeon	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
Arnheim	Moderate: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, frost action, cutbanks cave.	Wetness, droughty.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, droughty.
Pelkie	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
138 Bergland	Slight	Severe: ponding.	Severe: no water.	Ponding, percs slowly.	Ponding, droughty, slow intake.	Ponding, percs slowly.	Wetness, percs slowly.
139B*:							
Trimountain	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Large stones, wetness.	Large stones, wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
139B*:							
Paavola----------	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, large stones, slope.	Slope, large stones, wetness.	Large stones, wetness.	Large stones, wetness.
Waiska-----------	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
139D*:							
Trimountain------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Slope, large stones, wetness.	Large stones, wetness, slope.
Paavola----------	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, large stones, slope.	Slope, large stones, wetness.	Slope, large stones, wetness.	Large stones, wetness, slope.
Waiska-----------	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
139E*:							
Trimountain------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, rooting depth.	Large stones, slope, droughty.
Paavola----------	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, percs slowly.	Large stones, slope, droughty.
Waiska-----------	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
140B*:							
Trimountain------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Large stones, wetness.	Large stones, wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
140B*:							
Paavola	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, large stones, slope.	Slope, large stones, wetness.	Large stones, wetness.	Large stones, wetness.
Waiska	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
140D*, 140E*:							
Trimountain	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, rooting depth.	Large stones, slope, droughty.
Paavola	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, percs slowly.	Large stones, slope, droughty.
Waiska	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
142F*:							
Keweenaw	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Waiska	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
144F*:							
Graveraet	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, erodes easily.	Slope, erodes easily, droughty.
Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
145B*:							
Kalkaska	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Halfaday	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
146*:							
Cathro	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Gay	Moderate: seepage.	Severe: ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding, soil blowing, rooting depth.	Ponding, soil blowing.	Wetness, rooting depth.
147B*:							
Munising	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, rooting depth.	Wetness, droughty.
Liminga	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Alcona	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Droughty.
148B*:							
Graveraet	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Wetness, erodes easily.
Ocqueoc	Severe: seepage.	Severe: piping.	Severe: slow refill, cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Droughty.
Kalkaska	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
148D*:							
Graveraet	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, erodes easily.	Slope, erodes easily, droughty.
Ocqueoc	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, too sandy.	Slope, erodes easily, droughty.
Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
150B*:							
Richter	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing, erodes easily.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
Alcona	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Droughty.
151B Champion	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, large stones, wetness.	Large stones, wetness.	Large stones, wetness.
152B Kallio	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, slope.	Wetness, droughty, percs slowly.	Large stones, erodes easily.	Large stones, wetness.
153B*:							
Champion	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, large stones, wetness.	Large stones, wetness.	Large stones, wetness.
Karlin	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty.
Fence	Moderate: slope.	Severe: piping.	Severe: no water.	Frost action, slope.	Wetness, soil blowing, slope.	Erodes easily, wetness.	Erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
153D*:							
Champion	Severe: slope, seepage.	Severe: seepage, large stones.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, large stones, wetness.	Slope, large stones, wetness.	Large stones, wetness, slope.
Karlin	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty.
Fence	Severe: slope.	Severe: piping.	Severe: no water.	Frost action, slope.	Wetness, soil blowing, slope.	Slope, erodes easily, wetness.	Slope, erodes easily.
153E*:							
Champion	Severe: slope, seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, rooting depth.	Large stones, slope, droughty.
Karlin	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty.
Fence	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
154B*:							
Vilas	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Rubicon	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
154E*:							
Vilas	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
154E*:							
Rubicon----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
10B, 10D--------- Munising	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-6, A-4, A-1-b	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A-2, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
10E-------------- Munising	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-1-b, A-6, A-4	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-2-4, A-2-6, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
11A-------------- Skanee	0-6	Fine sandy loam	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	45-85	25-50	<28	NP-10
	6-12	Fine sandy loam, sandy loam.	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	55-85	25-50	<28	2-10
	12-40	Fine sandy loam, loamy sand, sandy clay loam.	SC, CL, SP-SC	A-2, A-4, A-6	0-4	95-100	85-100	40-90	10-55	25-35	7-15
	40-60	Sandy loam-------	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	50-70	25-40	<25	3-8
12--------------- Gay	0-5	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	5-16	Loamy sand, sandy loam.	SM, SM-SC, SW-SM, SP-SM	A-2-4, A-4, A-1-b	0-2	95-100	85-100	40-75	10-40	<25	NP-7
	16-24	Sandy loam, sandy clay loam.	SM, SM-SC, SC	A-2-4, A-4	0-2	95-100	85-100	50-85	25-50	<30	2-10
	24-60	Sandy loam, sandy clay loam.	SM-SC, SC	A-2-4, A-4, A-2-6, A-6	0-2	95-100	85-100	50-85	25-50	20-35	4-15
14A-------------- Assinins	0-33	Sand-------------	SM, SP-SM	A-2, A-3	0-5	95-100	85-100	50-70	5-30	---	NP
	33-45	Sandy loam, fine sandy loam.	SC, SM, SM-SC, ML	A-2, A-4	0-5	95-100	85-100	60-90	25-55	<25	NP-10
	45-60	Sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0-5	95-100	85-100	50-85	25-50	<20	NP-5
15B, 15D, 15E---- Kalkaska	0-3	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
16B, 16D---------Rubicon	0-4	Sand-------------	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP
	4-60	Sand-------------	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP
17A--------------Croswell	0-16	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	5-15	---	NP
	16-60	Sand-------------	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	3-15	---	NP
18A--------------Au Gres	0-19	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-65	5-15	---	NP
	19-60	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	85-100	40-60	5-15	---	NP
21B*, 21D*:											
Keweenaw---------	0-2	Gravelly loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b, A-4	0-10	80-100	60-75	30-75	10-40	<20	NP-10
	2-25	Loamy fine sand, gravelly loamy sand, sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b, A-4, A-3	0-25	85-100	60-100	30-85	5-45	<20	NP-10
	25-47	Fine sandy loam, sandy loam, gravelly loamy sand.	SM, SC, SP-SM, SM-SC	A-2, A-3, A-1-b, A-4	0-25	85-100	60-100	30-85	5-50	<30	NP-10
	47-60	Loamy sand, gravelly loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b	0-25	85-100	60-100	30-75	10-20	<20	NP-10
Kalkaska---------	0-3	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
22B*:											
Abbaye-----------	0-6	Loamy fine sand	SM, SM-SC, SP-SM	A-1-b, A-2-4, A-4	0-7	95-100	90-100	45-75	10-50	<25	2-7
	6-18	Sandy loam, fine sandy loam.	CL, CL-ML, SM-SC, SC	A-2-4, A-4	0-7	95-100	90-100	55-85	25-55	<25	4-10
	18-30	Sandy loam, loamy sand.	SM-SC, SC, SP-SC	A-2-4, A-4, A-1-b	0-7	95-100	90-100	45-75	10-40	<25	4-10
	30-34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
22B*:											
Munising--------	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-6, A-4, A-1-b	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A-2, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
23A*:											
Zeba------------	0-5	Fine sandy loam	SM, ML	A-2-4, A-4, A-1-b	0-15	90-100	80-100	40-85	15-55	<20	NP-4
	5-35	Sandy loam, fine sandy loam, loamy sand.	SM, ML, SM-SC, CL-ML	A-2-4, A-4, A-1-b	0-15	90-100	80-100	40-85	15-55	<25	NP-7
	35-39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Jacobsville-----	0-5	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	5-9	Sandy loam, loamy sand.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b	0-15	90-100	85-100	40-75	10-40	<25	NP-7
	9-23	Sandy loam-------	SM, SM-SC	A-2-4, A-4	0-15	90-100	85-100	50-70	25-40	<25	NP-7
	23-36	Sandy loam, channery loamy sand, very channery sandy loam.	SM, SM-SC, SP-SM, GM-GC	A-2-4, A-1-b, A-3	0-25	50-85	40-75	15-60	5-35	<25	NP-7
	36-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
24B-------------- Deerton	0-8	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0-5	95-100	90-100	45-70	5-15	---	NP
	8-27	Sand, loamy sand	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0-10	85-100	80-95	40-75	4-30	---	NP
	27-31	Weathered bedrock	---	---	---	---	---	---	---	---	---
	31-35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
25*:											
Lupton----------	0-8	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	8-60	Muck-------------	PT	A-8	0	---	---	---	---	---	---
Cathro----------	0-20	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	20-46	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	46-60	Fine sandy loam, silt loam, sandy loam.	SM-SC, CL-ML, SC, CL	A-4, A-6	0-5	80-100	65-100	60-100	35-90	20-40	4-20

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
26*:											
Dawson----------	0-10	Peat-------------	PT	A-8	0	---	---	---	---	---	---
	10-30	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	30-60	Sand, gravelly sand, loamy fine sand, fine sand.	SM-SC, SM, SC, SP-SM	A-2, A-3, A-1, A-4	0	45-100	35-100	15-90	0-45	<20	NP-10
Loxley----------	0-5	Peat-------------	PT	A-8	0	---	---	---	---	---	---
	5-60	Muck-------------	PT	A-8	0	---	---	---	---	---	---
27*:											
Histosols.											
Aquents.											
29B-------------- Waiska	0-6	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0-5	60-95	55-90	30-65	0-15	---	NP
	6-11	Gravelly sandy loam, very gravelly loamy coarse sand, gravelly sand.	SP-SM, GM, SM, SM-SC	A-1, A-3, A-2	8-15	30-80	25-75	15-55	5-35	<20	NP-6
	11-60	Very gravelly coarse sand, extremely gravelly coarse sand.	SP, GP, GP-GM, SP-SM	A-1	8-15	20-60	15-50	10-45	0-15	---	NP
30B*:											
Munising--------	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-6, A-4, A-1-b	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A-2, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
Skanee----------	0-6	Fine sandy loam	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	45-85	25-50	<28	NP-10
	6-12	Fine sandy loam, sandy loam.	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	55-85	25-50	<28	2-10
	12-40	Fine sandy loam, loamy sand, sandy clay loam.	SC, CL, SP-SC	A-2, A-4, A-6	0-4	95-100	85-100	40-90	10-55	25-35	7-15
	40-60	Sandy loam-------	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	50-70	25-40	<25	3-8
31A*:											
Skanee----------	0-6	Fine sandy loam	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	45-85	25-50	<28	NP-10
	6-12	Fine sandy loam, sandy loam.	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	55-85	25-50	<28	2-10
	12-40	Fine sandy loam, loamy sand, sandy clay loam.	SC, CL, SP-SC	A-2, A-4, A-6	0-4	95-100	85-100	40-90	10-55	25-35	7-15
	40-60	Sandy loam-------	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	50-70	25-40	<25	3-8

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
31A*:											
Gay	0-5	Muck	PT	A-8	0	---	---	---	---	---	---
	5-16	Loamy sand, sandy loam.	SM, SM-SC, SW-SM, SP-SM	A-2-4, A-4, A-1-b	0-2	95-100	85-100	40-75	10-40	<25	NP-7
	16-24	Sandy loam, sandy clay loam.	SM, SM-SC, SC	A-2-4, A-4	0-2	95-100	85-100	50-85	25-50	<30	2-10
	24-60	Sandy loam, sandy clay loam.	SM-SC, SC	A-2-4, A-4, A-2-6, A-6	0-2	95-100	85-100	50-85	25-50	20-35	4-15
32B Alcona	0-6	Loamy fine sand	SM	A-2-4	0-8	95-100	90-100	70-95	15-35	<25	NP-4
	6-19	Loamy fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0-8	85-100	70-100	55-95	15-65	<30	NP-10
	19-48	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4, A-1-b	0-8	95-100	90-100	35-75	15-65	<30	NP-10
	48-60	Stratified fine sand to very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-8	95-100	90-100	60-95	25-85	<30	NP-10
33B*, 33D*:											
Munising	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-6, A-4, A-1-b	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A-2, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
Yalmer	0-20	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0-2	95-100	75-100	35-70	0-15	---	NP
	20-47	Loamy sand, fine sandy loam.	SM, SM-SC, SP-SM	A-2, A-1-b, A-4	0-4	95-100	80-100	40-75	10-40	<25	NP-7
	47-60	Fine sandy loam, loamy fine sand.	SM, SC, SM-SC	A-2, A-4, A-1-b	0-4	95-100	75-100	45-70	20-40	<27	NP-8
34B Munising	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-6, A-4, A-1-b	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A-2, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
34D, 34E--------- Munising	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-1-b, A-6, A-4	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-2-4, A-2-6, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
35B, 35D--------- Graveraet	0-2	Loam-------------	ML, CL, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	2-21	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	21-39	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	39-60	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
35E-------------- Graveraet	0-2	Loam-------------	ML, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	2-21	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	21-39	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	39-60	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
36A-------------- Sturgeon	0-8	Silt loam--------	ML, CL-ML	A-4	0	100	95-100	85-100	60-90	<25	2-7
	8-34	Silt loam, very fine sandy loam, loamy very fine sand.	ML, SM, SC, CL	A-4	0	100	95-100	85-100	35-95	<30	NP-10
	34-60	Sand, fine sand	SM, SP-SM	A-2, A-1	0	95-100	75-100	35-50	5-35	---	NP
37--------------- Arnheim	0-4	Silt loam--------	ML, CL-ML, SM, SM-SC	A-4	0	100	100	90-100	40-90	<25	NP-6
	4-60	Stratified silt loam to sand.	ML, SM, CL, SC	A-2-4, A-4, A-3	0	100	100	50-100	5-90	<30	NP-10
38A-------------- Pelkie	0-7	Loamy fine sand	SM	A-2	0	100	100	50-95	15-35	---	NP
	7-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
41A-------------- Misery	0-7	Very fine sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-7	90-100	85-100	70-95	40-65	20-30	4-11
	7-11	Fine sandy loam, very fine sandy loam, silt loam.	SC, SM-SC, CL-ML, CL	A-4, A-6, A-2	0-7	90-100	85-100	55-100	30-90	20-30	4-11
	11-38	Fine sandy loam, loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-2	0-7	90-100	85-100	55-95	30-75	20-35	5-15
	38-60	Loam, silt loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-2	0-7	90-100	85-100	55-100	30-90	20-35	4-15
45*. Pits, borrow											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
46B*, 46D*:											
Karlin----------	0-3	Fine sandy loam	SM, ML	A-4, A-1, A-2	0	90-100	75-100	45-85	20-55	<20	NP-4
	3-21	Loamy fine sand, loamy sand, fine sandy loam.	SP-SM, SM, ML	A-2, A-4	0	90-100	75-100	60-100	10-55	<20	NP-4
	21-34	Loamy sand, fine sand, sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	90-100	75-100	35-80	0-35	---	NP
	34-60	Sand------------	SP, SP-SM, SM	A-2, A-3, A-1	0	80-100	75-100	35-70	0-15	---	NP
Kalkaska--------	0-3	Sand------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand------------	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
47B*:											
Ocqueoc---------	0-4	Fine sand--------	SM, SP-SM	A-3, A-2	0	100	100	50-80	5-15	<20	NP-4
	4-28	Sand, loamy sand, fine sand.	SM, SP-SM, SM-SC	A-3, A-2	0	100	100	50-80	5-30	<25	NP-4
	28-60	Stratified fine sand to silt loam.	SM-SC, CL-ML, CL, SC	A-6, A-4, A-2	0	100	100	65-95	20-85	20-40	4-20
Halfaday--------	0-3	Sand------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-70	5-15	---	NP
	3-60	Sand------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-75	5-15	---	NP
51A*:											
Allendale-------	0-12	Sand------------	SM, SW-SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-80	5-35	---	NP
	12-23	Sand, loamy sand	SM, SP-SM	A-2-4, A-3, A-4, A-1-b	0	95-100	90-100	45-80	5-40	---	NP
	23-60	Silty clay, clay	CH, MH	A-7	0	100	90-100	90-100	75-95	50-70	20-40
Rudyard---------	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	25-40	5-15
	9-24	Clay------------	CH	A-7	0	100	100	90-100	75-95	65-90	40-55
	24-60	Clay------------	CH	A-7	0	100	100	90-100	75-95	65-90	40-55
52B-------------- Allouez	0-7	Gravelly silt loam.	GM, SM, GM-GC, SM-SC	A-1-b, A-2-4, A-4	15-25	60-90	50-75	30-55	15-50	<25	NP-10
	7-12	Very gravelly fine sandy loam, gravelly loam, very gravelly coarse sandy loam.	GC, GM-GC, GM, SM	A-2, A-4, A-1-b	15-25	60-95	25-75	15-65	5-40	<25	NP-10
	12-60	Extremely gravelly coarse sand, very gravelly sand, extremely gravelly sand.	GW, GP, SP, GP-GM	A-1	15-50	25-95	20-45	10-35	0-10	---	NP
55*. Dumps, mine											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
56---------------- Jacobsville	0-5	Muck--------------	PT	A-8	0	---	---	---	---	---	---
	5-9	Sandy loam, loamy sand.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b	0-15	90-100	85-100	40-75	10-40	<25	NP-7
	9-23	Sandy loam--------	SM, SM-SC	A-2-4, A-4	0-15	90-100	85-100	50-70	25-40	<25	NP-7
	23-36	Sandy loam, channery loamy sand, very channery sandy loam.	SM, SM-SC, SP-SM, GM-GC	A-2-4, A-1-b, A-3	0-25	50-85	40-75	15-60	5-35	<25	NP-7
	36-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
58B*: Manistee---------	0-11	Sand--------------	SP-SM, SM	A-3, A-2-4, A-1-b	0-2	95-100	90-100	45-80	5-35	---	NP
	11-33	Sand, loamy sand, fine sand.	SP-SM, SM	A-2-4, A-1-b, A-3	0-2	95-100	90-100	45-80	5-35	---	NP
	33-50	Clay, silty clay	CH, CL	A-7	0	100	100	90-100	80-95	45-65	25-40
	50-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	85-95	45-65	20-40
Ontonagon--------	0-7	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-95	25-35	5-15
	7-24	Clay--------------	CH	A-7	0	100	100	90-100	75-95	65-90	40-55
	24-60	Clay--------------	CH	A-7	0	100	100	90-100	75-95	65-90	40-55
59B*: Graveraet--------	0-2	Loam--------------	ML, CL, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	2-21	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	21-39	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	39-60	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
Ocqueoc----------	0-4	Fine sand---------	SM, SP-SM	A-3, A-2	0	100	100	50-80	5-15	<20	NP-4
	4-28	Sand, loamy sand, fine sand.	SM, SP-SM, SM-SC	A-3, A-2	0	100	100	50-80	5-30	<25	NP-4
	28-60	Stratified fine sand to silt loam.	SM-SC, CL-ML, CL, SC	A-6, A-4, A-2	0	100	100	65-95	20-85	20-40	4-20
Kalkaska---------	0-3	Sand--------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand--------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand--------------	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
60B*: Nunica-----------	0-9	Silt loam---------	CL-ML, ML, CL	A-4, A-6	0	100	100	85-100	50-90	<30	3-11
	9-29	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	28-45	10-20
	29-60	Stratified silty clay loam to fine sandy loam.	CL-ML, CL, ML, SM	A-4, A-6, A-7	0	100	100	70-100	40-95	15-45	NP-20

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
60B*: Fence	0-2	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	<25	NP-7
	2-13	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, CL, SM, SC	A-4	0	100	100	85-100	40-100	<30	NP-9
	13-42	Silt, silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	<30	NP-12
	42-60	Stratified silt to very fine sand.	ML, CL-ML	A-4	0	100	100	85-100	50-100	<25	NP-7
60D*, 60E*: Nunica	0-9	Silt loam	CL-ML, ML, CL	A-4, A-6	0	100	100	85-100	50-90	<30	3-11
	9-29	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	28-45	10-20
	29-60	Stratified silty clay loam to fine sandy loam.	CL-ML, CL, ML, SM	A-4, A-6, A-7	0	100	100	70-100	40-95	15-45	NP-20
Fence	0-2	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	<25	NP-7
	2-13	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, CL, SM, SC	A-4	0	100	100	85-100	40-100	<30	NP-9
	13-42	Silt loam, very fine sandy loam, silt.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	<30	NP-12
	42-60	Stratified silt to very fine sand.	ML, CL-ML	A-4	0	100	100	85-100	50-100	<25	NP-7
61B, 61D, 61E: Ontonagon	0-7	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-95	25-35	5-15
	7-24	Clay	CH	A-7	0	100	100	90-100	75-95	65-90	40-55
	24-60	Clay	CH	A-7	0	100	100	90-100	75-95	65-90	40-55
65A: Rudyard	0-9	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	25-40	5-15
	9-24	Clay	CH	A-7	0	100	100	90-100	75-95	65-90	40-55
	24-60	Clay	CH	A-7	0	100	100	90-100	75-95	65-90	40-55
66B*: Munising	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-6, A-4, A-1-b	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A-2, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
66B*:											
Abbaye	0-6	Loamy fine sand	SM, SM-SC, SP-SM	A-1-b, A-2-4, A-4	0-7	95-100	90-100	45-75	10-50	<25	2-7
	6-18	Sandy loam, fine sandy loam.	CL, CL-ML, SM-SC, SC	A-2-4, A-4	0-7	95-100	90-100	55-85	25-55	<25	4-10
	18-30	Sandy loam, loamy sand.	SM-SC, SC, SP-SC	A-2-4, A-4, A-1-b	0-7	95-100	90-100	45-75	10-40	<25	4-10
	30-34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Kalkaska	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
66D*, 66F*:											
Munising	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-1-b, A-6, A-4	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-2-4, A-2-6, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
Abbaye	0-6	Loamy fine sand	SM, SM-SC, SP-SM	A-1-b, A-2-4	0-7	95-100	90-100	45-85	10-45	<25	2-7
	6-18	Sandy loam, fine sandy loam.	CL, CL-ML, SM-SC, SC	A-2-4, A-4	0-7	95-100	90-100	55-85	25-55	<25	4-10
	18-30	Sandy loam, loamy sand, fine sandy loam.	SM-SC, SC, SP-SC, SM	A-2-4, A-4, A-1-b	0-7	95-100	90-100	45-85	10-50	<25	4-10
	30-34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Kalkaska	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
67 Roscommon	0-6	Muck	PT	A-8	0	---	---	---	---	---	---
	6-60	Sand, loamy sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-75	0-30	<20	NP-4
68*. Dumps, stamp sand											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
69B*:											
Watton----------	0-7	Loam-------------	ML, CL, CL-ML	A-4	0-10	95-100	90-100	75-100	55-90	20-30	NP-10
	7-36	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0-10	95-100	90-100	75-100	55-95	32-50	14-30
	36-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0-10	95-100	90-100	75-100	55-95	25-50	11-25
Alstad----------	0-7	Loam-------------	CL, CL-ML, ML	A-4	0	95-100	95-100	80-100	55-100	<28	3-9
	7-13	Loam, silt loam, silty clay loam.	CL, SC	A-4, A-6, A-7	0	80-100	75-100	65-100	45-95	25-45	9-27
	13-29	Silty clay loam, clay loam.	CL, SC	A-6, A-4, A-2, A-7	0	80-100	75-100	60-100	25-80	20-45	9-28
	29-60	Loam, clay loam, silty clay loam.	SC, CL, SM, ML	A-6, A-4, A-2, A-1	0-3	80-100	75-100	45-95	20-80	<45	2-20
70B-------------- Watton	0-7	Loam-------------	ML, CL, CL-ML	A-4	0-10	95-100	90-100	75-100	55-90	20-30	NP-10
	7-36	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0-10	95-100	90-100	75-100	55-95	32-50	14-30
	36-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0-10	95-100	90-100	75-100	55-95	25-50	11-25
71A-------------- Richter	0-5	Very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	85-95	50-65	<30	3-9
	5-24	Very fine sandy loam, loamy very fine sand.	ML, CL, CL-ML	A-4	0	100	100	85-95	50-65	<30	3-9
	24-41	Loamy fine sand, very fine sandy loam, silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-2-4	0	100	100	90-100	40-90	<30	3-11
	41-60	Stratified fine sand to loamy fine sand.	SM, SM-SC, SC	A-2-4, A-1-b	0	100	100	75-95	20-50	<25	NP-6
72A-------------- Halfaday	0-3	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-70	5-15	---	NP
	3-60	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-75	5-15	---	NP
73B*:											
Froberg---------	0-6	Silt loam--------	CL	A-6	0	100	100	90-100	70-90	30-40	11-20
	6-32	Silty clay, clay	CH	A-7	0	100	100	95-100	75-95	50-80	25-55
	32-60	Sandy loam, sandy clay loam.	CL, SC, SM-SC	A-2-4, A-4, A-6, A-2-6	0-5	95-100	95-100	55-90	25-55	20-35	7-16
Rudyard---------	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	25-40	5-15
	9-24	Clay-------------	CH	A-7	0	100	100	90-100	75-95	65-90	40-55
	24-60	Clay-------------	CH	A-7	0	100	100	90-100	75-95	65-90	40-55

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
75A*:											
Croswell	0-16	Sand	SP-SM, SM	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	5-15	---	NP
	16-60	Sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	3-15	---	NP
Au Gres	0-19	Sand	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-65	5-15	---	NP
	19-60	Sand	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	85-100	40-60	5-15	---	NP
76A*:											
Au Gres	0-19	Sand	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-65	5-15	---	NP
	19-60	Sand	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	85-100	40-60	5-15	---	NP
Kinross	0-3	Muck	PT	A-8	0	---	---	---	---	---	---
	3-60	Sand	SP-SM, SM	A-3, A-2-4	0	100	100	50-80	5-30	---	NP
77*:											
Tawas	0-20	Muck	PT	A-8	0	---	---	---	---	---	---
	20-60	Sand, loamy sand, fine sand.	SP, SM, SP-SM	A-3, A-2-4, A-4, A-1-b	0	80-100	75-100	30-80	0-40	---	NP
Roscommon	0-6	Muck	PT	A-8	0	---	---	---	---	---	---
	6-60	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-75	0-30	<20	NP-4
78B Deer Park	0-4	Sand	SP-SM, SM	A-2, A-3	0	100	100	50-70	5-15	---	NP
	4-24	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-30	---	NP
	24-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	50-80	5-30	---	NP
79B*:											
Yalmer	0-20	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0-2	95-100	75-100	35-70	0-15	---	NP
	20-47	Loamy sand, fine sandy loam.	SM, SM-SC, SP-SM	A-2, A-1-b, A-4	0-4	95-100	80-100	40-75	10-40	<25	NP-7
	47-60	Fine sandy loam, loamy fine sand.	SM, SC, SM-SC	A-2, A-4, A-1-b	0-4	95-100	75-100	45-70	20-40	<27	NP-8
Assinins	0-33	Sand	SM, SP-SM	A-2, A-3	0-5	95-100	85-100	50-70	5-30	---	NP
	33-45	Sandy loam, fine sandy loam.	SC, SM, SM-SC, ML	A-2, A-4	0-5	95-100	85-100	60-90	25-55	<25	NP-10
	45-60	Sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0-5	95-100	85-100	50-85	25-50	<20	NP-5
83*:											
Udipsamments.											
Udorthents.											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
84B------------- Graveraet	0-2	Loam-------------	ML, CL, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	2-21	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	21-39	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	39-60	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
84D, 84E--------- Graveraet	0-2	Loam-------------	ML, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	2-21	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	21-39	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	39-60	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
86B, 86D--------- Trimountain	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	15-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
86E-------------- Trimountain	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	5-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
89B*, 89D*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	15-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
Paavola---------	0-4	Gravelly coarse sandy loam.	SM, SM-SC, GM, GP-GM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-4, A-2-4, A-1, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7
89E*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	5-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
89E*:											
Paavola---------	0-4	Gravelly coarse sandy loam.	GM, SM, SM-SC, SP-SM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-1, A-2-4, A-4, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7
90--------------- Witbeck	0-6	Very stony muck	PT	A-8	45-70	---	---	---	---	---	---
	6-10	Very stony silt loam.	ML, CL, CL-ML	A-4, A-6	45-60	90-100	85-100	75-100	60-90	<35	NP-15
	10-24	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SM-SC, SC	A-2-4, A-4	0-25	75-95	50-90	35-80	15-50	<35	NP-15
	24-60	Gravelly loamy sand, loamy sand.	SM, SM-SC, SC, SP-SM	A-2-4, A-1-b, A-3	0-25	75-95	50-90	30-70	5-25	<25	NP-7
92B*, 92D*, 92E*:											
Arcadian--------	0-5	Very cobbly fine sandy loam.	GM, SM-SC, SM, GP-GM	A-2-4, A-4, A-1-b, A-1-a	8-55	40-85	30-70	15-70	5-50	<25	NP-6
	5-18	Very gravelly very fine sandy loam, very gravelly fine sandy loam, very cobbly fine sandy loam.	GM, SM-SC, SM, GP-GM	A-2-4, A-4, A-1-b, A-1-a	8-55	40-85	30-70	15-70	5-50	<25	NP-6
	18-22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Michigamme------	0-4	Cobbly fine sandy loam.	SM, ML	A-2-4, A-4, A-1-b	20-50	95-100	75-100	45-95	20-90	<20	NP-4
	4-12	Cobbly sandy loam, fine sandy loam, gravelly sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4, A-1-b	0-50	75-100	50-95	25-80	20-90	<25	NP-7
	12-29	Cobbly sandy loam, gravelly fine sandy loam.	SM, SP-SM	A-2-4, A-4, A-1-b	0-30	75-100	50-95	25-80	5-50	<20	NP-4
	29-33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
95A*:											
Assinins	0-33	Sand	SM, SP-SM	A-2, A-3	0-5	95-100	85-100	50-70	5-30	---	NP
	33-45	Sandy loam, fine sandy loam.	SC, SM, SM-SC, ML	A-2, A-4	0-5	95-100	85-100	60-90	25-55	<25	NP-10
	45-60	Sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0-5	95-100	85-100	50-85	25-50	<20	NP-5
Skanee	0-6	Fine sandy loam	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	45-85	25-50	<28	NP-10
	6-12	Fine sandy loam, sandy loam.	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	55-85	25-50	<28	2-10
	12-40	Fine sandy loam, loamy sand, sandy clay loam.	SC, CL, SP-SC	A-2, A-4, A-6	0-4	95-100	85-100	40-90	10-55	25-35	7-15
	40-60	Sandy loam	SM, SM-SC, SC	A-2, A-4	0-4	95-100	85-100	50-70	25-40	<25	3-8
96B, 96D, 96E, 96F Liminga	0-10	Fine sand	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	10-39	Fine sand	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	39-60	Fine sand	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
98B*:											
Munising	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-6, A-4, A-1-b	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A-2, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
Yalmer	0-20	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0-2	95-100	75-100	35-70	0-15	---	NP
	20-47	Loamy sand, fine sandy loam.	SM, SM-SC, SP-SM	A-2, A-1-b, A-4	0-4	95-100	80-100	40-75	10-40	<25	NP-7
	47-60	Fine sandy loam, loamy fine sand.	SM, SC, SM-SC	A-2, A-4, A-1-b	0-4	95-100	75-100	45-70	20-40	<27	NP-8
98D*, 98E*:											
Munising	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-1-b, A-6, A-4	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-2-4, A-2-6, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
98D*, 98E*:											
Yalmer----------	0-20	Sand-------------	SP-SM, SP, SM	A-1-b, A-2-4, A-3	0-2	95-100	75-100	35-75	0-15	---	NP
	20-47	Loamy sand, fine sandy loam.	SM, SM-SC, SP-SM	A-1-b, A-2-4, A-4	0-4	95-100	80-100	40-75	10-40	<25	NP-6
	47-60	Fine sandy loam, loamy fine sand.	SM, SM-SC, SC	A-1-b, A-2-4, A-4	0-4	95-100	75-100	45-70	20-40	<27	NP-8
100A*:											
Au Gres---------	0-19	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-65	5-15	---	NP
	19-60	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	85-100	40-60	5-15	---	NP
Roscommon-------	0-6	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	6-60	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-75	0-30	<20	NP-4
101A------------- Net	0-5	Stony fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-2-4	25-50	95-100	85-95	35-95	30-90	<20	NP-6
	5-16	Gravelly silt loam, fine sandy loam, very fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-1-b, A-2-4	5-25	75-100	55-95	40-95	20-85	<20	NP-6
	16-36	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-4
	36-60	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-6
102A*:											
Net-------------	0-5	Stony fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-2-4	25-50	95-100	85-95	35-95	30-90	<20	NP-6
	5-16	Gravelly silt loam, fine sandy loam, very fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-1-b, A-2-4	5-25	75-100	55-95	40-95	20-85	<20	NP-6
	16-36	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-4
	36-60	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-6

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
102A*:											
Witbeck---------	0-6	Very stony muck	PT	A-8	45-70	---	---	---	---	---	---
	6-10	Very stony silt loam, mucky silt loam.	ML, CL, CL-ML	A-4, A-6	45-70	90-100	85-100	75-100	60-90	<35	NP-15
	10-24	Sandy loam, very fine sandy loam, gravelly loam.	SM, ML, CL, SC	A-2-4, A-4, A-1-b	0-25	75-95	50-90	45-90	20-70	<30	NP-10
	24-60	Gravelly loamy sand, loamy sand, gravelly sandy loam.	SM, SM-SC, SC, SP-SM	A-2-4, A-3, A-1-b	0-25	75-95	50-90	30-70	5-25	<25	NP-7
103B*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	15-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
Net-------------	0-5	Stony fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-2-4	25-50	95-100	85-95	35-95	30-90	<20	NP-6
	5-16	Gravelly silt loam, fine sandy loam, very fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-1-b, A-2-4	5-25	75-100	55-95	40-95	20-85	<20	NP-6
	16-36	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-4
	36-60	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-6
104D*:											
Urban land.											
Udorthents.											
106B*, 106D*, 106E*:											
Urban land.											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
106B*, 106D*, 106E*: Udorthents.											
Udipsamments.											
107B*, 107D*, 107E*: Kalkaska	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
Waiska	0-6	Sand	SM, SP-SM, SP	A-1, A-2, A-3	0-5	60-95	90-100	30-65	0-15	---	NP
	6-11	Gravelly sandy loam, very gravelly loamy coarse sand, gravelly coarse sand.	SP-SM, GM, SM, SM-SC	A-1, A-3, A-2	8-15	30-80	25-75	15-55	5-35	<20	NP-6
	11-60	Very gravelly coarse sand, extremely gravelly sand.	SP, GP, GP-GM, SP-SM	A-1	8-15	20-60	15-50	10-45	0-15	---	NP
108B Freda	0-4	Silt loam	ML, CL, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	4-8	Silt loam, loam	ML, CL, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	8-12	Channery silt loam, channery very fine sandy loam.	ML, CL, SM, GM	A-4, A-2, A-1	0-15	60-85	50-75	25-75	20-70	<30	NP-10
	12-16	Weathered bedrock	---	---	---	---	---	---	---	---	---
	16-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
110D*, 110E*: Kalkaska	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
Waiska	0-6	Sand	SM, SP-SM, SP	A-1, A-2, A-3	0-5	60-95	90-100	30-65	0-15	---	NP
	6-11	Gravelly sandy loam, very gravelly loamy coarse sand, gravelly coarse sand.	SP-SM, GM, SM, SM-SC	A-1, A-3, A-2	8-15	30-80	25-75	15-55	5-35	<20	NP-6
	11-60	Very gravelly coarse sand, extremely gravelly sand.	SP, GP, GP-GM, SP-SM	A-1	8-15	20-60	15-50	10-45	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
115B*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	15-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
Paavola---------	0-4	Gravelly coarse sandy loam.	SM, SM-SC, GM, GP-GM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-4, A-2-4, A-1, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7
115D*, 115E*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	5-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
115D*, 115E*:											
Paavola	0-4	Gravelly coarse sandy loam.	GM, SM, SM-SC, SP-SM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-1, A-2-4, A-4, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7
116B*:											
Trimountain	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	15-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
Paavola	0-4	Gravelly coarse sandy loam.	SM, SM-SC, GM, GP-GM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-4, A-2-4, A-1, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
116B*:											
Michigamme------	0-4	Cobbly fine sandy loam.	SM, ML	A-2-4, A-4, A-1-b	20-50	95-100	75-100	45-95	20-90	<20	NP-4
	4-12	Cobbly sandy loam, fine sandy loam, gravelly sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4, A-1-b	0-50	75-100	50-95	25-80	20-90	<25	NP-7
	12-29	Cobbly fine sandy loam, gravelly fine sandy loam.	SM, SP-SM, ML, SM-SC, CL-ML	A-2-4, A-4, A-1-b	0-30	75-100	50-95	25-80	5-50	<20	NP-4
	29-33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
116D*, 116E*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	5-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
Paavola---------	0-4	Gravelly coarse sandy loam.	GM, SM, SM-SC, SP-SM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-1, A-2-4, A-4, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
116D*, 116E*:											
Michigamme------	0-4	Cobbly fine sandy loam.	SM, ML	A-2-4, A-4, A-1-b	20-50	95-100	75-100	45-95	20-90	<20	NP-4
	4-12	Cobbly sandy loam, fine sandy loam, gravelly sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4, A-1-b	0-50	75-100	50-95	25-80	20-90	<25	NP-7
	12-29	Cobbly fine sandy loam, gravelly fine sandy loam.	SM, SP-SM, ML, SM-SC, CL-ML	A-2-4, A-4, A-1-b	0-30	75-100	50-95	25-80	5-50	<20	NP-4
	29-33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
119A*:											
Net-------------	0-5	Stony fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-2-4	25-50	95-100	85-95	35-95	30-90	<20	NP-6
	5-16	Gravelly silt loam, fine sandy loam, very fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-1-b, A-2-4	5-25	75-100	55-95	40-95	20-85	<20	NP-6
	16-36	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-4
	36-60	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-6
Witbeck---------	0-6	Very stony muck	PT	A-8	45-70	---	---	---	---	---	---
	6-10	Very stony silt loam, mucky silt loam.	ML, CL, CL-ML	A-4, A-6	45-70	90-100	85-100	75-100	60-90	<35	NP-15
	10-24	Sandy loam, very fine sandy loam, gravelly loam.	SM, ML, CL, SC	A-2-4, A-4, A-1-b	0-25	75-95	50-90	45-90	20-70	<30	NP-10
	24-60	Gravelly loamy sand, loamy sand, gravelly sandy loam.	SM, ML, CL, SC	A-2-4, A-4, A-1-b	0-25	75-95	50-90	45-90	15-70	<30	NP-10
125*:											
Kinross---------	0-3	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	3-60	Sand-------------	SP-SM, SM	A-3, A-2-4	0	100	100	50-80	5-30	---	NP
Dawson----------	0-6	Peat-------------	PT	A-8	0	---	---	---	---	---	---
	6-30	Mucky peat, muck	PT	A-8	0	---	---	---	---	---	---
	30-60	Sand, gravelly sand, very gravelly very fine sand.	SM-SC, SM, SC, SP-SM	A-2, A-3, A-1, A-4	0	45-100	35-100	15-90	0-45	<20	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
127B*, 127D*, 127E*:											
Keweenaw-------	0-2	Gravelly loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b, A-4	0-10	80-100	60-75	30-75	10-40	<20	NP-10
	2-25	Loamy fine sand, gravelly loamy sand, sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b, A-4, A-3	0-25	85-100	60-100	30-85	5-45	<20	NP-10
	25-47	Fine sandy loam, sandy loam, gravelly loamy sand.	SM, SC, SP-SM, SM-SC	A-2, A-3, A-1-b, A-4	0-25	85-100	60-100	30-85	5-50	<30	NP-10
	47-60	Loamy sand, gravelly loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b	0-25	85-100	60-100	30-75	10-20	<20	NP-10
Kalkaska-------	0-3	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
130B*:											
Munising--------	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-6, A-4, A-1-b	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A-2, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
Alcona----------	0-6	Loamy fine sand	SM	A-2-4	0-8	95-100	90-100	70-95	15-35	<25	NP-4
	6-19	Loamy fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0-8	95-100	90-100	55-95	15-65	<30	NP-10
	19-48	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4, A-1-b	0-8	95-100	90-100	35-75	15-65	<30	NP-10
	48-60	Stratified fine sand to very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-8	95-100	90-100	60-95	25-85	<30	NP-10
Liminga---------	0-10	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	10-39	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	39-60	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
130D*, 130F*:											
Munising--------	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-1-b, A-6, A-4	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-2-4, A-2-6, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
Alcona----------	0-6	Loamy fine sand	SM	A-2-4	0-8	95-100	90-100	70-95	15-35	<25	NP-4
	6-19	Loamy fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0-8	95-100	90-100	55-95	15-65	<30	NP-10
	19-48	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4, A-1-b	0-8	95-100	90-100	35-75	15-65	<30	NP-10
	48-60	Stratified fine sand to very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-8	95-100	90-100	60-95	25-85	<30	NP-10
Liminga---------	0-10	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	10-39	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	39-60	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
131B*:											
Graveraet-------	0-2	Loam-------------	ML, CL, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	2-21	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	21-39	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	39-60	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
Misery----------	0-7	Very fine sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-7	90-100	85-100	70-95	40-65	20-30	4-11
	7-11	Fine sandy loam, very fine sandy loam, silt loam.	SC, SM-SC, CL-ML, CL	A-4, A-6, A-2	0-7	90-100	85-100	55-100	30-90	20-30	4-11
	11-38	Fine sandy loam, loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-2	0-7	90-100	85-100	55-95	30-75	20-35	5-15
	38-60	Loam, silt loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-2	0-7	90-100	85-100	55-100	30-90	20-35	4-15
132B*, 132D*, 132F*:											
Kalkaska-------	0-3	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
132B*, 132D*, 132F*:											
Alcona---------	0-6	Loamy fine sand	SM	A-2-4	0-8	95-100	90-100	70-95	15-35	<25	NP-4
	6-19	Loamy fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0-8	95-100	90-100	55-95	15-65	<30	NP-10
	19-48	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4, A-1-b	0-8	95-100	90-100	35-75	15-65	<30	NP-10
	48-60	Stratified fine sand to very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-8	95-100	90-100	60-95	25-85	<30	NP-10
133B*, 133D*, 133E*:											
Liminga--------	0-10	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	10-39	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	39-60	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
Alcona---------	0-6	Loamy fine sand	SM	A-2-4	0-8	95-100	90-100	70-95	15-35	<25	NP-4
	6-19	Loamy fine sand, very fine sandy loam, sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0-8	95-100	90-100	55-95	15-65	<30	NP-10
	19-48	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4, A-1-b	0-8	95-100	90-100	35-75	15-65	<30	NP-10
	48-60	Stratified fine sand to very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-8	95-100	90-100	60-95	25-85	<30	NP-10
134A*:											
Halfaday--------	0-3	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-70	5-15	---	NP
	3-60	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-75	5-15	---	NP
Au Gres---------	0-19	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-65	5-15	---	NP
	19-60	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	85-100	40-60	5-15	---	NP
135D*:											
Deer Park-------	0-4	Sand-------------	SP-SM, SM	A-2, A-3	0	100	100	50-70	5-15	---	NP
	4-23	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-30	---	NP
	23-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	50-80	5-30	---	NP
Kinross---------	0-3	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	3-60	Sand-------------	SP-SM, SM	A-3, A-2-4	0	100	100	50-80	5-30	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
136B*:											
Michigamme------	0-4	Cobbly fine sandy loam.	SM, ML	A-2-4, A-4, A-1-b	20-50	95-100	75-100	45-95	20-90	<20	NP-4
	4-12	Cobbly sandy loam, fine sandy loam, gravelly sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4, A-1-b	0-50	75-100	50-90	25-80	20-90	<25	NP-7
	12-29	Cobbly fine sandy loam, gravelly fine sandy loam.	SM, SP-SM, ML, SM-SC, CL-ML	A-2-4, A-4, A-1-b	0-30	75-100	50-95	25-80	5-50	<20	NP-4
	29-33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Net------------	0-5	Stony fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-2-4	25-50	95-100	85-95	35-95	30-90	<20	NP-6
	5-16	Gravelly silt loam, fine sandy loam, very fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-1-b, A-2-4	5-25	75-100	55-95	40-95	20-85	<20	NP-6
	16-36	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-4
	36-60	Gravelly sandy loam, gravelly loamy sand, gravelly fine sandy loam.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	5-25	75-100	55-80	25-70	5-45	<20	NP-6
137A*:											
Sturgeon--------	0-8	Silt loam--------	ML, CL-ML	A-4	0	100	95-100	85-100	60-90	<25	2-7
	8-34	Silt loam, very fine sandy loam, loamy very fine sand.	ML, SM, SC, CL	A-4	0	100	95-100	85-100	35-95	<30	NP-10
	34-60	Sand, fine sand	SM, SP-SM	A-2, A-1	0	95-100	75-100	35-50	5-35	---	NP
Arnheim---------	0-4	Silt loam--------	ML, CL-ML, SM, SM-SC	A-4	0	100	100	90-100	40-90	<25	NP-6
	4-60	Stratified silt loam to sand.	ML, SM, CL, SC	A-2-4, A-4, A-3	0	100	100	50-100	5-90	<30	NP-10
Pelkie----------	0-7	Loamy fine sand	SM	A-2	0	100	100	50-95	15-35	---	NP
	7-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
138------------- Bergland	0-5	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	5-20	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	55-70	30-40
	20-60	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	55-70	30-40

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
139B*, 139D*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	15-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
Paavola---------	0-4	Gravelly coarse sandy loam.	SM, SM-SC, GM, GP-GM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-4, A-2-4, A-1, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7
Waiska----------	0-6	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0-5	60-95	90-100	30-65	0-15	---	NP
	6-11	Gravelly sandy loam, very gravelly loamy coarse sand, gravelly sand.	SP-SM, GM, SM, SM-SC	A-1, A-3, A-2	8-15	30-80	25-75	15-55	5-35	<20	NP-6
	11-60	Very gravelly coarse sand, extremely gravelly coarse sand.	SP, GP, GP-GM, SP-SM	A-1	8-15	20-60	15-50	10-45	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
139E*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	5-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
Paavola---------	0-4	Gravelly coarse sandy loam.	GM, SM, SM-SC, SP-SM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-1, A-2-4, A-4, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7
Waiska----------	0-6	Sand------------	SM, SP-SM, SP	A-1, A-2, A-3	0-5	60-95	90-100	30-65	0-15	---	NP
	6-11	Gravelly sandy loam, very gravelly loamy coarse sand, gravelly sand.	SP-SM, GM, SM, SM-SC	A-1, A-3, A-2	8-15	30-80	25-75	15-55	5-35	<20	NP-6
	11-60	Very gravelly coarse sand, extremely gravelly coarse sand.	SP, GP, GP-GM, SP-SM	A-1	8-15	20-60	15-50	10-45	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
140B*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	15-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
Paavola---------	0-4	Gravelly coarse sandy loam.	SM, SM-SC, GM, GP-GM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-4, A-2-4, A-1, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7
Waiska----------	0-6	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0-5	60-95	90-100	30-65	0-15	---	NP
	6-11	Gravelly sandy loam, very gravelly loamy coarse sand, gravelly sand.	SP-SM, GM, SM, SM-SC	A-1, A-3, A-2	8-15	30-80	25-75	15-55	5-35	<20	NP-6
	11-60	Very gravelly coarse sand, extremely gravelly coarse sand.	SP, GP, GP-GM, SP-SM	A-1	8-15	20-60	15-50	10-45	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
140D*, 140E*:											
Trimountain-----	0-4	Cobbly fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	5-25	90-100	85-100	55-95	30-65	<25	NP-6
	4-26	Cobbly fine sandy loam, gravelly fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	5-25	70-100	60-100	45-95	25-65	<25	NP-6
	26-45	Gravelly loamy sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM, SM-SC, GM, GP-GM	A-4, A-2-4, A-1-b, A-3	3-25	60-95	50-90	30-90	5-50	<25	NP-6
	45-60	Gravelly fine sand, extremely gravelly coarse sand, very gravelly sandy loam.	GW, GP, SP, SM-SC	A-1, A-2-4, A-3	3-15	35-85	25-75	10-70	0-30	<25	NP-6
Paavola---------	0-4	Gravelly coarse sandy loam.	GM, SM, SM-SC, SP-SM	A-2-4, A-1	5-20	55-90	50-75	25-55	10-35	<25	NP-7
	4-29	Extremely gravelly coarse sand, very gravelly loamy sand.	GW, SP, SP-SM, GM-GC	A-1, A-2-4	8-55	25-80	25-50	5-40	0-30	<20	NP-4
	29-57	Gravelly loamy fine sand, extremely gravelly fine sandy loam, sandy loam.	SM, SP-SM, SM-SC, GM	A-1, A-2-4, A-4, A-3	8-55	50-95	25-85	20-70	5-50	<25	NP-7
	57-60	Very gravelly sandy loam, gravelly sandy loam, extremely gravelly sand.	GW, GM-GC, SP, SM	A-1, A-2-4, A-3	8-55	30-95	25-85	10-60	0-30	<25	NP-7
Waiska----------	0-6	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0-5	60-95	90-100	30-65	0-15	---	NP
	6-11	Gravelly sandy loam, very gravelly loamy coarse sand, gravelly sand.	SP-SM, GM, SM, SM-SC	A-1, A-3, A-2	8-15	30-80	25-75	15-55	5-35	<20	NP-6
	11-60	Very gravelly coarse sand, extremely gravelly coarse sand	SP, GP, GP-GM, SP-SM	A-1	8-15	20-60	15-50	10-45	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
142F*:											
Keweenaw	0-2	Gravelly loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b, A-4	0-10	80-100	60-75	30-75	10-40	<20	NP-10
	2-25	Loamy fine sand, gravelly loamy sand, sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b, A-4, A-3	0-25	85-100	60-100	30-85	5-45	<20	NP-10
	25-47	Fine sandy loam, sandy loam, gravelly loamy sand.	SM, SC, SP-SM, SM-SC	A-2, A-3, A-1-b, A-4	0-25	85-100	60-100	30-85	5-50	<30	NP-10
	47-60	Loamy sand, gravelly loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b	0-25	85-100	60-100	30-75	10-20	<20	NP-10
Kalkaska	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
Waiska	0-6	Sand	SM, SP-SM, SP	A-1, A-2, A-3	0-5	60-95	90-100	30-65	0-15	---	NP
	6-11	Gravelly sandy loam, very gravelly loamy coarse sand, gravelly sand.	SP-SM, GM, SM, SM-SC	A-1, A-3, A-2	8-15	30-80	25-75	15-55	5-35	<20	NP-6
	11-60	Very gravelly coarse sand, extremely gravelly coarse sand.	SP, GP, GP-GM, SP-SM	A-1	8-15	20-60	15-50	10-45	0-15	---	NP
144F*:											
Graveraet	0-2	Loam	ML, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	2-21	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	21-39	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	39-60	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
Kalkaska	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
145B*:											
Kalkaska	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
145B*:											
Halfaday--------	0-3	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-70	5-15	---	NP
	3-60	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-75	5-15	---	NP
146*:											
Cathro----------	0-20	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	20-46	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	46-60	Fine sandy loam, silt loam, sandy loam.	SM-SC, CL-ML, SC, CL	A-4, A-6	0-5	80-100	65-100	60-100	35-90	20-40	4-20
Gay-------------	0-5	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	5-16	Loamy sand, sandy loam.	SM, SM-SC, SW-SM, SP-SM	A-2-4, A-4, A-1-b	0-2	95-100	85-100	40-75	10-40	<25	NP-7
	16-24	Sandy loam, sandy clay loam.	SM, SM-SC, SC	A-2-4, A-4	0-2	95-100	85-100	50-85	25-50	<30	2-10
	24-60	Sandy loam, sandy clay loam.	SM-SC, SC	A-2-4, A-4, A-2-6, A-6	0-2	95-100	85-100	50-85	25-50	20-35	4-15
147B*:											
Munising--------	0-12	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-4	0-5	95-100	85-100	40-80	10-40	<20	NP-4
	12-25	Sandy loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2-4	0-5	95-100	85-100	50-85	25-55	<25	NP-6
	25-48	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SM-SC	A-2, A-6, A-4, A-1-b	0-5	95-100	85-100	40-80	10-40	15-35	NP-15
	48-60	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A-2, A-6, A-4	0-5	95-100	85-100	50-90	25-55	15-35	NP-15
Liminga---------	0-10	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	10-39	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
	39-60	Fine sand--------	SM	A-2-4	0	100	90-100	60-80	15-35	---	NP
Alcona----------	0-6	Loamy fine sand	SM	A-2-4	0-8	95-100	90-100	70-95	15-35	<25	NP-4
	6-19	Loamy fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0-8	95-100	90-100	55-95	15-65	<30	NP-10
	19-48	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4, A-1-b	0-8	95-100	90-100	35-75	15-65	<30	NP-10
	48-60	Stratified fine sand to very fine sandy loam.	SM, ML	A-4, A-2-4	0-8	95-100	90-100	60-95	25-85	<30	NP-7

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
148B*:											
Graveraet	0-2	Loam	ML, CL, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	2-21	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	21-39	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	39-60	Fine sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
Ocqueoc	0-4	Fine sand	SM, SP-SM	A-3, A-2	0	100	100	50-80	5-15	<20	NP-4
	4-28	Sand, loamy sand, fine sand.	SM, SP-SM, SM-SC	A-3, A-2	0	100	100	50-80	5-30	<25	NP-4
	28-60	Stratified fine sand to silt loam.	SM-SC, CL-ML, CL, SC	A-6, A-4, A-2	0	100	100	65-95	20-85	20-40	4-20
Kalkaska	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP
148D*:											
Graveraet	0-2	Loam	ML, CL-ML	A-4	0-15	85-100	75-100	65-100	50-90	<30	NP-10
	2-21	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	21-39	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
	39-60	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0-15	85-100	75-100	50-85	30-70	<30	NP-10
Ocqueoc	0-4	Fine sand	SM, SP-SM	A-3, A-2	0	100	100	50-80	5-15	<20	NP-4
	4-28	Sand, loamy sand, fine sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	50-80	5-30	<20	NP-7
	28-60	Stratified fine sand to silt loam.	SM-SC, CL-ML, CL, SC	A-2, A-4, A-6	0	100	100	65-95	20-85	20-40	4-20
Kalkaska	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-28	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	28-60	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	100	95-100	45-70	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
150B*:											
Richter---------	0-5	Very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	85-95	50-65	<30	3-9
	5-24	Very fine sandy loam, loamy very fine sand.	ML, CL, CL-ML	A-4	0	100	100	85-95	50-65	<30	3-9
	24-41	Loamy fine sand, very fine sandy loam, silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-2-4	0	100	100	90-100	40-90	<30	3-11
	41-60	Stratified fine sand to loamy fine sand.	SM, SM-SC, SC	A-2-4, A-1-b	0	100	100	75-95	20-50	<25	NP-6
Alcona----------	0-6	Loamy fine sand	SM	A-2-4	0-8	95-100	90-100	70-95	15-35	<25	NP-4
	6-19	Loamy fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0-8	95-100	90-100	55-95	15-65	<30	NP-10
	19-48	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4, A-1-b	0-8	95-100	90-100	35-75	15-65	<30	NP-10
	48-60	Stratified fine sand to very fine sandy loam.	SM, ML	A-4, A-2-4	0-8	95-100	90-100	60-95	25-85	<30	NP-7
151B------------- Champion	0-4	Cobbly very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	20-50	95-100	85-100	70-100	40-90	<20	NP-4
	4-18	Cobbly very fine sandy loam, silt loam, fine sandy loam.	SM, CL-ML, ML, SM-SC	A-2-4, A-4	0-50	95-100	85-100	55-100	30-90	<25	NP-7
	18-49	Gravelly fine sandy loam, sandy loam, gravelly loamy fine sand.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	0-20	75-100	50-90	25-80	5-50	<25	NP-6
	49-60	Gravelly fine sandy loam, sandy loam, gravelly loamy sand.	SM, SM-SC, SP-SM	A-2-4, A-1-b, A-3, A-4	0-20	80-100	50-90	25-80	5-50	<25	NP-6
152B------------- Kallio	0-5	Cobbly very fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4	20-40	95-100	85-100	70-95	40-85	<25	NP-7
	5-22	Silt loam, very fine sandy loam, fine sandy loam.	ML, SM, CL-ML, SM-SC	A-2-4, A-4	0-15	95-100	85-100	55-95	30-85	<25	NP-7
	22-36	Silt loam, very fine sandy loam, loam.	ML, CL, SC, SM	A-4, A-6	0-15	95-100	85-100	60-95	35-90	10-40	NP-20
	36-60	Gravelly loam, loam.	ML, CL, SC, SM	A-4, A-6	0-15	90-100	70-100	60-95	40-90	20-40	NP-20

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
153B*, 153D*:											
Champion--------	0-4	Cobbly very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	20-50	95-100	85-100	70-100	40-90	<20	NP-4
	4-18	Cobbly very fine sandy loam, silt loam, fine sandy loam.	SM, CL-ML, ML, SM-SC	A-2-4, A-4	0-50	95-100	85-100	55-100	30-90	<25	NP-7
	18-49	Gravelly fine sandy loam, sandy loam, gravelly loamy fine sand.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	0-20	75-100	50-90	25-80	5-50	<25	NP-6
	49-60	Gravelly fine sandy loam, sandy loam, gravelly loamy sand.	SM, SM-SC, SP-SM	A-2-4, A-1-b, A-3, A-4	0-20	80-100	50-90	25-80	5-50	<25	NP-6
Karlin----------	0-3	Fine sandy loam	SM, ML	A-4, A-1, A-2	0	90-100	75-100	45-85	20-55	<20	NP-4
	3-21	Loamy fine sand, loamy sand, fine sandy loam.	SP-SM, SM, ML	A-2, A-4	0	90-100	75-100	60-100	10-55	<20	NP-4
	21-34	Loamy sand, fine sand, sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	90-100	75-100	35-80	0-35	---	NP
	34-60	Sand------------	SP, SP-SM, SM	A-2, A-3, A-1	0	80-100	75-100	35-70	0-15	---	NP
Fence-----------	0-2	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	<25	NP-7
	2-13	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, CL, SM, SC	A-4	0	100	100	85-100	40-100	<30	NP-9
	13-42	Silt, silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	<30	NP-12
	42-60	Stratified silt to very fine sand.	ML, CL-ML	A-4	0	100	100	85-100	50-100	<25	NP-7
153E*:											
Champion--------	0-4	Cobbly very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	20-50	95-100	85-100	70-100	40-90	<20	NP-4
	4-18	Cobbly very fine sandy loam, silt loam, fine sandy loam.	SM, CL-ML, ML, SM-SC	A-2-4, A-4	0-50	95-100	85-100	55-100	30-90	<25	NP-7
	18-49	Gravelly fine sandy loam, gravelly sandy loam, gravelly loamy fine sand.	SM, SM-SC, SP-SM	A-2-4, A-4, A-1-b, A-3	0-20	75-100	50-90	25-80	5-50	<25	NP-6
	49-60	Gravelly fine sandy loam, gravelly sandy loam, gravelly loamy sand.	SM, SM-SC, SP-SM	A-2-4, A-1-b, A-3, A-4	0-20	80-100	50-90	25-80	5-50	<25	NP-6

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
153E*:											
Karlin----------	0-3	Fine sandy loam	SM, ML	A-4, A-1, A-2	0	90-100	75-100	45-85	20-55	<20	NP-4
	3-25	Loamy fine sand, loamy sand, fine sandy loam.	SP-SM, SM, ML	A-2, A-4	0	90-100	75-100	60-100	10-55	<20	NP-4
	25-30	Loamy sand, fine sand, sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	90-100	75-100	35-80	0-35	---	NP
	30-60	Sand-------------	SP, SP-SM, SM	A-2, A-3, A-1	0	80-100	75-100	35-70	0-15	---	NP
Fence-----------	0-2	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	<25	NP-7
	2-13	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, CL, SM, SC	A-4	0	100	100	85-100	40-100	<30	NP-9
	13-42	Silt loam, very fine sandy loam, silt.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	<30	NP-12
	42-60	Stratified silt to very fine sand.	ML, CL-ML	A-4	0	100	100	85-100	50-100	<25	NP-7
154B*, 154E*:											
Vilas-----------	0-2	Loamy sand-------	SM, SP-SM	A-1, A-2	0	80-100	75-100	35-90	12-30	---	NP
	2-19	Loamy sand-------	SP-SM, SM	A-1, A-2	0	80-100	75-100	35-90	12-30	---	NP
	19-35	Sand-------------	SM, SP-SM	A-1, A-2, A-3	0	80-100	75-100	35-90	5-20	---	NP
	35-60	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	80-100	75-100	35-90	1-20	---	NP
Rubicon---------	0-4	Sand-------------	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP
	4-60	Sand-------------	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
10B, 10D---------Munising	0-12	5-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low-----------	0.17	4	2	1-3
	12-25	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low-----------	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low-----------	0.24			
	48-60	10-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low-----------	0.24			
10E--------------Munising	0-12	2-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low-----------	0.17	4	2	1-3
	12-25	2-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low-----------	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low-----------	0.24			
	48-60	5-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low-----------	0.24			
11A--------------Skanee	0-6	5-15	1.30-1.60	2.0-6.0	0.09-0.18	4.5-6.0	Low-----------	0.24	3	3	2-3
	6-12	8-18	1.40-1.70	0.6-2.0	0.11-0.17	4.5-6.0	Low-----------	0.24			
	12-40	15-25	1.75-2.10	<0.06	0.04-0.06	4.5-6.0	Low-----------	0.24			
	40-60	8-18	1.40-1.70	0.6-2.0	0.02-0.04	4.5-6.0	Low-----------	0.24			
12---------------Gay	0-5	---	0.30-0.40	0.6-2.0	0.35-0.45	5.1-6.5	--------------	----	5	2	>25
	5-16	5-15	1.15-1.60	0.6-2.0	0.07-0.14	5.1-6.5	Low-----------	0.24			
	16-24	5-18	1.30-1.80	0.6-2.0	0.10-0.18	5.1-6.5	Low-----------	0.24			
	24-60	10-25	1.80-1.95	0.6-2.0	0.09-0.17	5.6-7.3	Low-----------	0.24			
14A--------------Assinins	0-33	0-10	1.25-1.60	6.0-20	0.5-1.5	4.5-6.0	Low-----------	0.15	4	1	1-3
	33-45	5-18	1.50-1.90	0.2-2.0	0.10-0.13	5.1-6.0	Low-----------	0.37			
	45-60	5-18	1.50-1.90	0.6-2.0	0.10-0.16	4.5-6.0	Low-----------	0.24			
15B, 15D, 15E----Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low-----------	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low-----------	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
16B, 16D---------Rubicon	0-4	0-5	1.35-1.55	6.0-20	0.05-0.09	4.5-6.0	Low-----------	0.15	5	1	.5-1
	4-60	0-10	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low-----------	0.15			
17A--------------Croswell	0-16	0-10	1.30-1.55	6.0-20	0.06-0.09	3.6-6.5	Low-----------	0.15	5	1	.5-2
	16-60	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-8.4	Low-----------	0.15			
18A--------------Au Gres	0-19	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low-----------	0.15	5	1	.5-8
	19-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low-----------	0.15			
21B*, 21D*:											
Keweenaw---------	0-2	2-15	1.35-1.60	2.0-6.0	0.07-0.10	4.5-6.5	Low-----------	0.10	5	8	.5-2
	2-25	2-15	1.45-1.80	2.0-6.0	0.08-0.11	4.5-6.5	Low-----------	0.17			
	25-47	0-15	1.50-1.80	0.6-6.0	0.06-0.14	4.5-6.5	Low-----------	0.17			
	47-60	2-15	1.50-1.70	2.0-6.0	0.04-0.10	5.1-6.5	Low-----------	0.17			
Kalkaska---------	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low-----------	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low-----------	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
22B*:											
Abbaye-----------	0-6	5-15	1.30-1.65	0.6-2.0	0.09-0.12	3.6-6.0	Low-----------	0.17	4	2	.5-3
	6-18	5-15	1.35-1.65	0.6-2.0	0.11-0.15	4.5-6.0	Low-----------	0.24			
	18-30	5-15	1.35-1.70	0.6-2.0	0.08-0.14	4.5-6.0	Low-----------	0.24			
	30-34	---	---	---	---	---	--------------	----			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
22B*:											
Munising--------	0-12	5-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low----------	0.17	4	2	1-3
	12-25	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low----------	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low----------	0.24			
	48-60	10-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low----------	0.24			
23A*:											
Zeba------------	0-5	2-12	1.30-1.70	0.6-2.0	0.07-0.18	4.5-6.0	Low----------	0.24	4	3	2-4
	5-35	5-15	1.40-1.80	0.6-2.0	0.07-0.18	4.5-6.0	Low----------	0.24			
	35-39	---	---	---	---	---	-------------	----			
Jacobsville-----	0-5	---	0.30-0.40	0.6-6.0	0.35-0.45	4.5-6.5	-------------	----	4	2	40-60
	5-9	3-12	1.30-1.60	0.6-2.0	0.09-0.15	4.5-6.5	Low----------	0.24			
	9-23	5-15	1.30-1.60	0.6-2.0	0.12-0.15	5.1-6.5	Low----------	0.28			
	23-36	3-12	1.30-1.60	0.6-2.0	0.05-0.11	5.1-6.5	Low----------	0.20			
	36-40	---	---	---	---	---	-------------	----			
24B-------------- Deerton	0-8	2-10	1.30-1.60	6.0-20	0.06-0.10	3.6-6.0	Low----------	0.15	4	1	.5-2
	8-27	3-12	1.30-1.60	2.0-20	0.05-0.10	3.6-6.0	Low----------	0.15			
	27-31	---	---	---	---	---	-------------	----			
	31-35	---	---	---	---	---	-------------	----			
25*:											
Lupton----------	0-8	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	5	2	70-90
	8-60	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----			
Cathro----------	0-20	---	0.28-0.45	0.2-6.0	0.45-0.55	4.5-7.8	-------------	----	5	2	60-85
	20-46	---	0.15-0.30	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----			
	46-60	10-25	1.50-1.70	0.2-2.0	0.11-0.22	5.6-8.4	Low----------	0.37			
26*:											
Dawson----------	0-10	---	0.15-0.30	>6.0	0.55-0.65	3.6-4.4	-------------	----	4	7	65-85
	10-30	---	0.15-0.40	0.2-6.0	0.35-0.45	3.6-4.4	-------------	----			
	30-60	0-10	1.55-1.75	6.0-20	0.03-0.10	4.5-6.5	Low----------	0.15			
Loxley----------	0-5	---	0.30-0.40	>6.0	0.35-0.65	<4.5	-------------	----	5	7	70-90
	5-60	---	0.10-0.35	0.2-6.0	0.35-0.45	<4.5	-------------	----			
27*:											
Histosols.											
Aquents.											
29B-------------- Waiska	0-6	0-5	1.35-1.45	6.0-20	0.02-0.04	4.5-6.0	Low----------	0.15	2	1	.5-1
	6-11	2-12	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low----------	0.10			
	11-60	0-5	1.45-1.60	>20	0.01-0.03	4.5-6.0	Low----------	0.10			
30B*:											
Munising--------	0-12	5-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low----------	0.17	4	2	1-3
	12-25	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low----------	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low----------	0.24			
	48-60	10-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low----------	0.24			
Skanee----------	0-6	5-15	1.30-1.60	2.0-6.0	0.09-0.18	4.5-6.0	Low----------	0.24	3	3	2-3
	6-12	8-18	1.40-1.70	0.6-2.0	0.11-0.17	4.5-6.0	Low----------	0.24			
	12-40	15-25	1.75-2.10	<0.06	0.04-0.06	4.5-6.0	Low----------	0.24			
	40-60	8-18	1.40-1.70	0.6-2.0	0.02-0.04	4.5-6.0	Low----------	0.24			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
31A*:											
Skanee----------	0-6	5-15	1.30-1.60	2.0-6.0	0.09-0.18	4.5-6.0	Low----------	0.24	3	3	2-3
	6-12	8-18	1.40-1.70	0.6-2.0	0.11-0.17	4.5-6.0	Low----------	0.24			
	12-40	15-25	1.75-2.10	<0.06	0.04-0.06	4.5-6.0	Low----------	0.24			
	40-60	8-18	1.40-1.70	0.6-2.0	0.02-0.04	4.5-6.0	Low----------	0.24			
Gay-------------	0-5	---	0.30-0.40	0.6-2.0	0.35-0.45	5.1-6.5	-------------	----	5	2	>25
	5-16	5-15	1.15-1.60	0.6-2.0	0.07-0.14	5.1-6.5	Low----------	0.24			
	16-24	5-18	1.30-1.80	0.6-2.0	0.10-0.18	5.1-6.5	Low----------	0.24			
	24-60	10-25	1.80-1.95	0.6-2.0	0.09-0.17	5.6-7.3	Low----------	0.24			
32B-------------- Alcona	0-6	2-15	1.30-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low----------	0.17	5	2	1-3
	6-19	5-20	1.35-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low----------	0.17			
	19-48	5-18	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low----------	0.17			
	48-60	5-18	1.35-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low----------	0.24			
33B*, 33D*:											
Munising--------	0-12	5-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low----------	0.17	4	2	1-3
	12-25	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low----------	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low----------	0.24			
	48-60	10-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low----------	0.24			
Yalmer----------	0-20	0-5	1.35-1.45	6.0-20	0.05-0.09	3.6-6.0	Low----------	0.15	4	1	2-3
	20-47	0-12	1.75-2.05	0.06-0.2	0.02-0.04	3.6-6.0	Low----------	0.24			
	47-60	5-15	1.40-1.65	0.6-2.0	0.02-0.04	3.6-6.0	Low----------	0.24			
34B-------------- Munising	0-12	5-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low----------	0.17	4	2	1-3
	12-25	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low----------	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low----------	0.24			
	48-60	10-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low----------	0.24			
34D, 34E--------- Munising	0-12	2-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low----------	0.17	4	2	1-3
	12-25	2-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low----------	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low----------	0.24			
	48-60	5-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low----------	0.24			
35B, 35D, 35E---- Graveraet	0-2	7-18	1.30-1.60	0.6-2.0	0.17-0.22	4.5-6.5	Low----------	0.37	3	5	1-3
	2-21	5-18	1.35-1.65	0.6-2.0	0.14-0.20	5.1-6.5	Low----------	0.43			
	21-39	5-18	1.80-2.00	<0.06	0.03-0.05	5.1-6.5	Low----------	0.32			
	39-60	5-18	1.60-1.80	0.2-2.0	0.03-0.05	6.6-8.4	Low----------	0.37			
36A-------------- Sturgeon	0-8	2-15	1.40-1.65	0.6-2.0	0.22-0.24	4.5-6.5	Low----------	0.37	4	5	2-3
	8-34	5-18	1.50-1.70	0.6-2.0	0.10-0.22	4.5-6.5	Low----------	0.28			
	34-60	0-10	1.50-1.65	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
37--------------- Arnheim	0-4	12-18	1.15-1.60	0.6-6.0	0.12-0.35	5.1-7.3	Low----------	0.37	5	8	2-4
	4-60	5-18	1.50-1.80	0.6-2.0	0.05-0.22	5.1-7.3	Low----------	0.37			
38A-------------- Pelkie	0-7	5-12	1.30-1.55	6.0-20	0.08-0.12	4.5-6.5	Low----------	0.17	5	2	1-2
	7-60	0-10	1.25-1.65	6.0-20	0.05-0.09	4.5-6.5	Low----------	0.15			
41A-------------- Misery	0-7	10-20	1.35-1.50	0.6-2.0	0.17-0.20	3.6-6.5	Low----------	0.37	3	3	1-3
	7-11	10-20	1.45-1.70	0.6-2.0	0.17-0.20	4.5-6.5	Low----------	0.43			
	11-38	12-25	1.80-2.00	<0.06	0.03-0.05	5.1-7.8	Low----------	0.32			
	38-60	10-25	1.60-1.80	0.2-2.0	0.03-0.05	6.6-8.4	Low----------	0.37			
45*. Pits, borrow											

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
46B*, 46D*:											
Karlin----------	0-3	12-15	1.35-1.60	2.0-6.0	0.15-0.17	3.6-6.5	Low----------	0.24	4	3	.5-2
	3-21	2-15	1.35-1.60	2.0-6.0	0.08-0.16	3.6-6.5	Low----------	0.17			
	21-34	0-15	1.40-1.65	6.0-20	0.03-0.08	4.5-6.5	Low----------	0.17			
	34-60	0-10	1.40-1.70	6.0-20	0.03-0.04	5.1-7.3	Low----------	0.15			
Kalkaska--------	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low----------	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low----------	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
47B*:											
Ocqueoc---------	0-4	0-10	1.30-1.60	6.0-20	0.07-0.09	4.5-6.5	Low----------	0.15	5	1	1-3
	4-28	0-15	1.30-1.60	6.0-20	0.06-0.12	4.5-6.5	Low----------	0.15			
	28-60	10-27	1.50-1.80	0.2-0.6	0.05-0.21	5.6-7.8	Moderate-----	0.15			
Halfaday--------	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	4.5-6.5	Low----------	0.15	5	1	.5-2
	3-60	0-10	1.35-1.50	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15			
51A*:											
Allendale-------	0-12	0-10	1.25-1.40	6.0-20	0.07-0.09	4.5-7.3	Low----------	0.15	4	1	1-3
	12-23	0-15	1.35-1.45	6.0-20	0.06-0.10	4.5-7.3	Low----------	0.17			
	23-60	40-60	1.45-1.70	<0.06	0.08-0.12	6.1-8.4	Moderate-----	0.32			
Rudyard---------	0-9	15-27	1.00-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Moderate-----	0.37	3	5	3-4
	9-24	60-85	1.10-1.40	<0.06	0.11-0.13	5.1-7.3	High---------	0.28			
	24-60	60-80	1.35-1.45	<0.06	0.11-0.13	7.4-8.4	High---------	0.28			
52B-------------- Allouez	0-7	10-18	1.35-1.60	2.0-6.0	0.10-0.18	3.6-6.0	Low----------	0.24	3	8	1-2
	7-12	5-20	1.30-1.60	2.0-6.0	0.04-0.16	4.5-6.0	Low----------	0.17			
	12-60	0-5	1.55-1.70	>20	0.01-0.03	5.1-6.5	Low----------	0.10			
55*. Dumps, mine											
56-------------- Jacobsville	0-5	---	0.30-0.40	0.6-6.0	0.35-0.45	4.5-6.5	-------------	----	4	2	40-60
	5-9	3-12	1.30-1.60	0.6-2.0	0.09-0.15	4.5-6.5	Low----------	0.24			
	9-23	5-15	1.30-1.60	0.6-2.0	0.12-0.15	5.1-6.5	Low----------	0.28			
	23-36	3-12	1.30-1.60	0.6-2.0	0.05-0.11	5.1-6.5	Low----------	0.20			
	36-40	---	---	---	---	---	-------------	----			
58B*:											
Manistee--------	0-11	0-10	1.35-1.60	6.0-20	0.07-0.09	4.5-7.3	Low----------	0.15	4	1	2-4
	11-33	2-12	1.35-1.60	6.0-20	0.06-0.10	5.1-7.3	Low----------	0.17			
	33-50	35-60	1.50-1.70	<0.06	0.08-0.12	5.1-7.3	High---------	0.32			
	50-60	35-60	1.60-1.70	0.06-0.2	0.08-0.16	6.6-8.4	High---------	0.32			
Ontonagon-------	0-7	20-27	1.00-1.30	0.6-2.0	0.21-0.23	4.5-6.5	Low----------	0.43	3	6	1-3
	7-24	60-85	1.35-1.45	<0.06	0.11-0.13	4.5-7.3	High---------	0.28			
	24-60	60-85	1.35-1.45	<0.06	0.11-0.13	7.4-8.4	High---------	0.28			
59B*:											
Graveraet-------	0-2	7-18	1.30-1.60	0.6-2.0	0.17-0.22	4.5-6.5	Low----------	0.37	3	5	1-3
	2-21	5-18	1.35-1.65	0.6-2.0	0.14-0.20	5.1-6.5	Low----------	0.43			
	21-39	5-18	1.80-2.00	<0.06	0.03-0.05	5.1-6.5	Low----------	0.32			
	39-60	5-18	1.60-1.80	0.2-2.0	0.03-0.05	6.6-8.4	Low----------	0.37			
Ocqueoc---------	0-4	0-10	1.30-1.60	6.0-20	0.07-0.09	4.5-6.5	Low----------	0.15	5	1	1-3
	4-28	0-15	1.30-1.60	6.0-20	0.06-0.12	4.5-6.5	Low----------	0.15			
	28-60	10-27	1.50-1.80	0.2-0.6	0.05-0.21	5.6-7.8	Moderate-----	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
59B*:											
Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
60B*, 60D*, 60E*:											
Nunica	0-9	8-20	1.35-1.60	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	5	5	1-3
	9-29	18-35	1.35-1.60	0.2-0.6	0.18-0.22	4.5-7.3	Low	0.37			
	29-60	5-35	1.30-1.60	0.2-2.0	0.14-0.20	5.6-8.4	Low	0.37			
Fence	0-2	5-15	1.20-1.35	0.6-2.0	0.20-0.22	3.6-6.5	Low	0.37	5	3	1-2
	2-13	5-18	1.50-1.60	0.2-0.6	0.11-0.22	3.6-6.5	Low	0.37			
	13-42	8-18	1.50-1.60	0.2-0.6	0.17-0.22	3.6-6.5	Low	0.37			
	42-60	5-15	1.50-1.60	0.2-0.6	0.17-0.22	4.5-7.8	Low	0.37			
61B, 61D, 61E Ontonagon	0-7	20-27	1.00-1.30	0.6-2.0	0.21-0.23	4.5-6.5	Low	0.43	3	6	1-3
	7-24	60-85	1.35-1.45	<0.06	0.11-0.13	4.5-7.3	High	0.28			
	24-60	60-85	1.35-1.45	<0.06	0.11-0.13	7.4-8.4	High	0.28			
65A Rudyard	0-9	15-27	1.00-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Moderate	0.37	3	5	3-4
	9-24	60-85	1.10-1.40	<0.06	0.11-0.13	5.1-7.3	High	0.28			
	24-60	60-80	1.35-1.45	<0.06	0.11-0.13	7.4-8.4	High	0.28			
66B*:											
Munising	0-12	5-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low	0.17	4	2	1-3
	12-25	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low	0.24			
	48-60	10-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low	0.24			
Abbaye	0-6	5-15	1.30-1.65	0.6-2.0	0.09-0.12	3.6-6.0	Low	0.17	4	2	.5-3
	6-18	5-15	1.35-1.65	0.6-2.0	0.11-0.15	4.5-6.0	Low	0.24			
	18-30	5-15	1.35-1.70	0.6-2.0	0.08-0.14	4.5-6.0	Low	0.24			
	30-34	---	---	---	---	---	-------------	----			
Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
66D*, 66F*:											
Munising	0-12	2-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low	0.17	4	2	1-3
	12-25	2-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low	0.24			
	48-60	5-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low	0.24			
Abbaye	0-6	5-15	1.30-1.65	0.6-2.0	0.09-0.12	3.6-6.0	Low	0.17	4	2	.5-3
	6-18	5-15	1.35-1.65	0.6-2.0	0.11-0.15	4.5-6.0	Low	0.24			
	18-30	5-15	1.35-1.70	0.6-2.0	0.08-0.14	4.5-6.0	Low	0.24			
	30-34	---	---	---	---	---	-------------	----			
Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
67 Roscommon	0-6	---	0.30-0.40	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	5	2	40-60
	6-60	0-10	1.45-1.70	6.0-20	0.05-0.09	4.5-8.4	Low	0.17			
68*. Dumps, stamp sand											

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
69B*:											
Watton----------	0-7	15-25	1.50-1.70	0.6-2.0	0.19-0.24	3.6-7.3	Low----------	0.37	5	5	1-2
	7-36	24-35	1.55-1.80	0.2-0.6	0.14-0.20	4.5-7.8	Moderate-----	0.37			
	36-60	24-35	1.65-1.80	0.2-0.6	0.13-0.18	6.6-8.4	Moderate-----	0.37			
Alstad----------	0-7	7-18	1.35-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.37	5	5	2-4
	7-13	18-35	1.55-1.65	0.6-2.0	0.14-0.22	5.1-7.3	Low----------	0.32			
	13-29	18-35	1.55-1.70	0.6-2.0	0.13-0.19	5.1-7.8	Low----------	0.32			
	29-60	8-35	1.60-1.80	0.2-0.6	0.09-0.19	5.6-8.4	Low----------	0.32			
70B-------------- Watton	0-7	15-25	1.50-1.70	0.6-2.0	0.19-0.24	3.6-7.3	Low----------	0.37	5	5	1-2
	7-36	24-35	1.55-1.80	0.2-0.6	0.14-0.20	4.5-7.8	Moderate-----	0.37			
	36-60	24-35	1.65-1.80	0.2-0.6	0.13-0.18	6.6-8.4	Moderate-----	0.37			
71A-------------- Richter	0-5	8-18	1.20-1.50	2.0-6.0	0.20-0.22	4.5-7.3	Low----------	0.37	4	3	2-3
	5-24	5-18	1.35-1.60	2.0-6.0	0.14-0.19	5.0-7.3	Low----------	0.43			
	24-41	5-20	1.35-1.60	2.0-6.0	0.13-0.22	5.6-7.3	Low----------	0.43			
	41-60	2-12	1.50-1.65	2.0-6.0	0.06-0.10	6.0-8.4	Low----------	0.17			
72A-------------- Halfaday	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	4.5-6.5	Low----------	0.15	5	1	.5-2
	3-60	0-10	1.35-1.50	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15			
73B*:											
Froberg---------	0-6	18-27	1.50-1.65	0.6-2.0	0.22-0.24	5.1-6.5	Low----------	0.37	3	6	2-3
	6-32	40-80	1.40-1.70	<0.06	0.09-0.13	5.1-7.8	Moderate-----	0.28			
	32-60	12-25	1.60-1.75	0.2-2.0	0.11-0.17	5.1-6.5	Low----------	0.28			
Rudyard---------	0-9	15-27	1.00-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Moderate-----	0.37	3	5	3-4
	9-24	60-85	1.10-1.40	<0.06	0.11-0.13	5.1-7.3	High---------	0.28			
	24-60	60-80	1.35-1.45	<0.06	0.11-0.13	7.4-8.4	High---------	0.28			
75A*:											
Croswell--------	0-16	0-10	1.30-1.55	6.0-20	0.06-0.09	3.6-6.5	Low----------	0.15	5	1	.5-2
	16-60	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-8.4	Low----------	0.15			
Au Gres---------	0-19	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low----------	0.15	5	1	.5-8
	19-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low----------	0.15			
76A*:											
Au Gres---------	0-19	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low----------	0.15	5	1	.5-8
	19-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low----------	0.15			
Kinross---------	0-3	---	0.10-0.35	2.0-6.0	0.35-0.45	3.6-5.0	-------------	----	5	2	>50
	3-60	0-10	1.40-1.70	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
77*:											
Tawas-----------	0-20	---	0.30-0.55	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	4	2	40-60
	20-60	0-10	1.40-1.65	6.0-20	0.03-0.10	5.6-8.4	Low----------	0.15			
Roscommon-------	0-6	---	0.30-0.40	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	5	2	40-60
	6-60	0-10	1.45-1.70	6.0-20	0.05-0.09	4.5-8.4	Low----------	0.17			
78B-------------- Deer Park	0-4	0-10	1.30-1.55	6.0-20	0.04-0.07	5.1-6.0	Low----------	0.15	5	1	.5-1
	4-24	0-10	1.40-1.60	6.0-20	0.03-0.06	5.1-6.5	Low----------	0.15			
	24-60	0-10	1.40-1.55	6.0-20	0.03-0.05	5.1-6.5	Low----------	0.15			
79B*:											
Yalmer----------	0-20	0-5	1.35-1.45	6.0-20	0.05-0.09	3.6-6.0	Low----------	0.15	4	1	2-3
	20-47	5-15	1.75-2.05	<0.06	0.02-0.04	3.6-6.0	Low----------	0.24			
	47-60	5-15	1.40-1.65	0.6-2.0	0.02-0.04	3.6-6.0	Low----------	0.24			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
79B*:											
Assinins--------	0-33	0-10	1.25-1.60	6.0-20	0.5-1.5	4.5-6.0	Low----------	0.15	4	1	1-3
	33-45	5-18	1.50-1.90	0.2-2.0	0.10-0.13	5.1-6.0	Low----------	0.37			
	45-60	5-18	1.50-1.90	0.6-2.0	0.10-0.16	4.5-6.0	Low----------	0.24			
83*:											
Udipsamments.											
Udorthents.											
84B, 84D, 84E---- Graveraet	0-2	7-18	1.30-1.60	0.6-2.0	0.17-0.22	4.5-6.5	Low----------	0.37	3	5	1-3
	2-21	5-18	1.35-1.65	0.6-2.0	0.14-0.20	5.1-6.5	Low----------	0.43			
	21-39	5-18	1.80-2.00	<0.06	0.03-0.05	5.1-6.5	Low----------	0.32			
	39-60	5-18	1.60-1.80	0.2-2.0	0.03-0.05	6.6-8.4	Low----------	0.37			
86B, 86D, 86E---- Trimountain	0-4	2-12	1.30-1.60	0.6-2.0	0.10-0.20	3.6-6.0	Low----------	0.17	3	8	1-3
	4-26	2-12	1.35-1.65	0.6-2.0	0.10-0.17	3.6-6.0	Low----------	0.17			
	26-45	2-12	1.80-2.30	<0.06	0.01-0.04	3.6-6.0	Low----------	0.17			
	45-60	0-12	1.55-2.00	0.6-6.0	0.01-0.04	4.5-6.5	Low----------	0.10			
89B*, 89D*, 89E*:											
Trimountain-----	0-4	2-12	1.30-1.60	0.6-2.0	0.10-0.20	3.6-6.0	Low----------	0.17	3	8	1-3
	4-26	2-12	1.35-1.65	0.6-2.0	0.10-0.17	3.6-6.0	Low----------	0.17			
	26-45	2-12	1.80-2.30	<0.06	0.01-0.04	3.6-6.0	Low----------	0.17			
	45-60	0-12	1.55-2.00	0.6-6.0	0.01-0.04	4.5-6.5	Low----------	0.10			
Paavola---------	0-4	2-12	1.30-1.60	2.0-20	0.09-0.11	4.5-6.0	Low----------	0.17	4	8	1-3
	4-29	2-10	1.30-1.70	0.06-0.2	0.01-0.04	4.5-6.0	Low----------	0.10			
	29-57	2-12	1.80-2.10	0.06-0.2	0.01-0.04	4.5-6.0	Low----------	0.17			
	57-60	2-12	1.70-2.10	0.6-6.0	0.01-0.04	4.5-6.5	Low----------	0.17			
90-------------- Witbeck	0-6	---	0.15-0.40	0.2-6.0	0.35-0.45	4.5-6.0	-------------	----	5	2	40-70
	6-10	5-25	1.25-1.50	0.6-2.0	0.08-0.16	4.5-6.0	Low----------	0.28			
	10-24	5-20	1.50-1.65	0.6-2.0	0.08-0.16	4.5-6.0	Low----------	0.24			
	24-60	5-15	1.45-1.65	2.0-6.0	0.05-0.10	5.1-6.5	Low----------	0.15			
92B*, 92D*:											
Arcadian--------	0-5	2-12	1.30-1.60	0.6-2.0	0.06-0.11	5.1-6.5	Low----------	0.17	2	8	1-3
	5-18	2-12	1.35-1.70	0.6-2.0	0.06-0.11	5.1-6.5	Low----------	0.17			
	18-22	---	---	---	---	---	-------------	----			
Michigamme------	0-4	1-10	1.15-1.65	0.6-2.0	0.06-0.18	3.6-6.5	Low----------	0.28	4	8	1-3
	4-12	1-15	1.25-1.80	0.6-2.0	0.06-0.22	3.6-6.5	Low----------	0.28			
	12-29	1-10	1.30-1.85	0.6-2.0	0.05-0.16	3.6-6.5	Low----------	0.20			
	29-33	---	---	---	---	---	-------------	----			
Rock outcrop.											
92E*:											
Arcadian--------	0-5	2-12	1.30-1.60	0.6-2.0	0.06-0.11	5.1-6.5	Low----------	0.17	2	8	1-3
	5-18	2-12	1.35-1.70	0.6-2.0	0.06-0.11	5.1-6.5	Low----------	0.17			
	18-22	---	---	---	---	---	-------------	----			
Michigamme------	0-4	1-10	1.15-1.65	0.6-2.0	0.08-0.24	3.6-6.5	Low----------	0.28	4	8	1-3
	4-12	1-15	1.25-1.80	0.6-2.0	0.07-0.22	3.6-6.5	Low----------	0.28			
	12-29	1-10	1.30-1.85	0.6-2.0	0.05-0.16	3.6-6.5	Low----------	0.20			
	29-33	---	---	---	---	---	-------------	----			
Rock outcrop.											

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
95A*:											
Assinins	0-33	0-10	1.25-1.60	6.0-20	0.5-1.5	4.5-6.0	Low	0.15	4	1	1-3
	33-45	5-18	1.50-1.90	0.2-2.0	0.10-0.13	5.1-6.0	Low	0.37			
	45-60	5-18	1.50-1.90	0.6-2.0	0.10-0.16	4.5-6.0	Low	0.24			
Skanee	0-6	5-15	1.30-1.60	2.0-6.0	0.09-0.18	4.5-6.0	Low	0.24	3	3	2-3
	6-12	8-18	1.40-1.70	0.6-2.0	0.11-0.17	4.5-6.0	Low	0.24			
	12-40	15-25	1.75-2.10	<0.06	0.04-0.06	4.5-6.0	Low	0.24			
	40-60	8-18	1.40-1.70	0.6-2.0	0.02-0.04	4.5-6.0	Low	0.24			
96B, 96D, 96E, 96F Liminga	0-10	0-10	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-2
	10-39	0-10	1.30-1.60	6.0-20	0.06-0.08	4.5-6.5	Low	0.15			
	39-60	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-6.5	Low	0.15			
98B*:											
Munising	0-12	5-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low	0.17	4	2	1-3
	12-25	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low	0.24			
	48-60	10-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low	0.24			
Yalmer	0-20	0-5	1.35-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	4	1	2-3
	20-47	5-15	1.75-2.05	<0.06	0.02-0.04	3.6-6.0	Low	0.24			
	47-60	5-15	1.40-1.65	0.6-2.0	0.02-0.04	3.6-6.0	Low	0.24			
98D*, 98E*:											
Munising	0-12	2-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low	0.17	4	2	1-3
	12-25	2-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low	0.24			
	48-60	5-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low	0.24			
Yalmer	0-20	0-5	1.35-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	4	1	2-3
	20-47	5-15	1.75-2.05	<0.06	0.02-0.04	3.6-6.0	Low	0.24			
	47-60	2-15	1.40-1.65	0.6-2.0	0.02-0.04	3.6-6.0	Low	0.24			
100A*:											
Au Gres	0-19	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low	0.15	5	1	.5-8
	19-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low	0.15			
Roscommon	0-6	---	0.30-0.40	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	5	2	40-60
	6-60	0-10	1.45-1.70	6.0-20	0.05-0.09	4.5-8.4	Low	0.17			
101A Net	0-5	2-12	1.30-1.70	0.6-2.0	0.13-0.20	3.6-6.0	Low	0.28	4	8	2-6
	5-16	2-12	1.40-1.65	0.6-2.0	0.06-0.21	3.6-6.0	Low	0.28			
	16-36	2-10	1.75-2.05	<0.06	0.01-0.02	3.6-6.0	Low	0.20			
	36-60	2-10	1.30-1.70	0.6-6.0	0.01-0.02	5.1-6.5	Low	0.20			
102A*:											
Net	0-5	2-12	1.30-1.70	0.6-2.0	0.13-0.20	3.6-6.0	Low	0.28	4	8	2-6
	5-16	2-12	1.40-1.65	0.6-2.0	0.06-0.21	3.6-6.0	Low	0.28			
	16-36	2-10	1.75-2.05	<0.06	0.01-0.02	3.6-6.0	Low	0.20			
	36-60	2-10	1.30-1.70	0.6-6.0	0.01-0.02	5.1-6.5	Low	0.20			
Witbeck	0-6	---	0.15-0.40	0.2-6.0	0.35-0.45	4.5-6.0	-------------	----	5	8	40-70
	6-10	5-25	1.25-1.60	0.6-2.0	0.08-0.16	4.5-6.0	Low	0.24			
	10-24	5-20	1.55-1.75	0.6-2.0	0.04-0.18	4.5-6.0	Low	0.24			
	24-60	5-15	1.45-1.65	0.2-6.0	0.05-0.10	5.1-6.5	Low	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
103B*:											
Trimountain	0-4	2-12	1.30-1.60	0.6-2.0	0.10-0.20	3.6-6.0	Low	0.17	3	8	1-3
	4-26	2-12	1.35-1.65	0.6-2.0	0.10-0.17	3.6-6.0	Low	0.17			
	26-45	2-12	1.80-2.30	<0.06	0.01-0.04	3.6-6.0	Low	0.17			
	45-60	0-12	1.55-2.00	0.6-6.0	0.01-0.04	4.5-6.5	Low	0.10			
Net	0-5	2-12	1.30-1.70	0.6-2.0	0.13-0.20	3.6-6.0	Low	0.28	4	8	2-6
	5-16	2-12	1.40-1.65	0.6-2.0	0.06-0.21	3.6-6.0	Low	0.28			
	16-36	2-10	1.75-2.05	<0.06	0.01-0.02	3.6-6.0	Low	0.20			
	36-60	2-10	1.30-1.70	0.6-6.0	0.01-0.02	5.1-6.5	Low	0.20			
104D*:											
Urban land.											
Udorthents.											
106B*, 106D*, 106E*:											
Urban land.											
Udorthents.											
Udipsamments.											
107B*, 107D*, 107E*:											
Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
Waiska	0-6	0-5	1.35-1.45	6.0-20	0.02-0.04	4.5-6.0	Low	0.15	2	1	.5-1
	6-11	2-12	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low	0.10			
	11-60	0-5	1.45-1.60	>20	0.01-0.03	4.5-6.0	Low	0.10			
108B Freda	0-4	7-18	1.35-1.55	0.6-2.0	0.22-0.24	3.6-6.0	Low	0.37	2	5	1-3
	4-8	7-18	1.40-1.70	0.6-2.0	0.18-0.21	4.5-6.0	Low	0.43			
	8-12	7-18	1.40-1.70	0.6-2.0	0.14-0.16	4.5-6.0	Low	0.32			
	12-16	---	---	---	---	---	-------------	----			
	16-20	---	---	---	---	---	-------------	----			
110D*, 110E*:											
Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
Waiska	0-6	0-5	1.35-1.45	6.0-20	0.02-0.04	4.5-6.0	Low	0.15	2	1	.5-1
	6-11	2-12	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low	0.10			
	11-60	0-5	1.45-1.60	>20	0.01-0.03	4.5-6.0	Low	0.10			
115B*, 115D*, 115E*:											
Trimountain	0-4	2-12	1.30-1.60	0.6-2.0	0.10-0.20	3.6-6.0	Low	0.17	3	8	1-3
	4-26	2-12	1.35-1.65	0.6-2.0	0.10-0.17	3.6-6.5	Low	0.17			
	26-45	2-12	1.80-2.30	<0.06	0.01-0.04	3.6-6.0	Low	0.17			
	45-60	0-12	1.55-2.00	0.6-6.0	0.01-0.04	4.5-6.5	Low	0.10			
Paavola	0-4	2-12	1.30-1.60	2.0-20	0.09-0.11	4.5-6.0	Low	0.17	4	8	1-3
	4-29	2-10	1.30-1.70	0.6-6.0	0.01-0.04	4.5-6.5	Low	0.10			
	29-57	2-12	1.80-2.10	<0.06	0.01-0.04	4.5-6.0	Low	0.17			
	57-60	2-12	1.70-2.10	<0.06	0.01-0.04	4.5-6.5	Low	0.17			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
116B*:											
Trimountain-----	0-4	2-12	1.30-1.60	0.6-2.0	0.10-0.20	3.6-6.0	Low----------	0.17	3	8	1-3
	4-26	2-12	1.35-1.65	0.6-2.0	0.10-0.17	3.6-6.0	Low----------	0.17			
	26-45	2-12	1.80-2.30	<0.06	0.01-0.04	3.6-6.0	Low----------	0.17			
	45-60	0-12	1.55-2.00	0.6-6.0	0.01-0.04	4.5-6.5	Low----------	0.10			
Paavola---------	0-4	2-12	1.30-1.60	2.0-20	0.09-0.11	4.5-6.0	Low----------	0.17	4	8	1-3
	4-29	2-10	1.30-1.70	0.06-0.2	0.01-0.04	4.5-6.5	Low----------	0.10			
	29-57	2-12	1.80-2.10	<0.06	0.01-0.04	4.5-6.0	Low----------	0.17			
	57-60	2-12	1.70-2.10	<0.06	0.01-0.04	4.5-6.5	Low----------	0.17			
Michigamme------	0-4	1-10	1.15-1.65	0.6-2.0	0.06-0.18	3.6-6.5	Low----------	0.28	4	8	1-3
	4-12	1-15	1.25-1.80	0.6-2.0	0.06-0.22	3.6-6.5	Low----------	0.28			
	12-29	1-10	1.30-1.85	0.6-2.0	0.05-0.16	3.6-6.5	Low----------	0.20			
	29-33	---	---	---	---	---	-------------	----			
116D*, 116E*:											
Trimountain-----	0-4	2-12	1.30-1.60	0.6-2.0	0.10-0.20	3.6-6.0	Low----------	0.17	3	8	1-3
	4-26	2-12	1.35-1.65	0.6-2.0	0.10-0.17	3.6-6.0	Low----------	0.17			
	26-45	2-12	1.80-2.30	<0.06	0.01-0.04	3.6-6.0	Low----------	0.17			
	45-60	0-12	1.55-2.00	0.6-6.0	0.01-0.04	4.5-6.5	Low----------	0.10			
Paavola---------	0-4	2-12	1.30-1.60	2.0-20	0.09-0.11	4.5-6.0	Low----------	0.17	4	8	1-3
	4-29	2-10	1.30-1.70	0.06-0.2	0.01-0.04	4.5-6.5	Low----------	0.10			
	29-57	2-12	1.80-2.10	<0.06	0.01-0.04	4.5-6.0	Low----------	0.17			
	57-60	2-12	1.70-2.10	<0.06	0.01-0.04	4.5-6.5	Low----------	0.17			
Michigamme------	0-4	1-10	1.15-1.65	0.6-2.0	0.08-0.24	3.6-6.5	Low----------	0.28	4	8	1-3
	4-12	1-15	1.25-1.80	0.6-2.0	0.07-0.22	3.6-6.5	Low----------	0.28			
	12-29	1-10	1.30-1.85	0.6-2.0	0.05-0.16	3.6-6.5	Low----------	0.20			
	29-33	---	---	---	---	---	-------------	----			
119A*:											
Net-------------	0-5	2-12	1.30-1.70	0.6-2.0	0.13-0.20	3.6-6.0	Low----------	0.28	4	8	2-6
	5-16	2-12	1.40-1.65	0.6-2.0	0.06-0.21	3.6-6.0	Low----------	0.28			
	16-36	2-10	1.75-2.05	<0.06	0.01-0.02	3.6-6.0	Low----------	0.20			
	36-60	2-10	1.30-1.70	0.6-6.0	0.01-0.02	5.1-6.5	Low----------	0.20			
Witbeck---------	0-6	---	0.15-0.40	0.2-6.0	0.35-0.45	4.5-6.0	-------------	----	5	8	40-70
	6-10	5-25	1.25-1.60	0.6-2.0	0.08-0.16	4.5-6.0	Low----------	0.24			
	10-24	5-20	1.55-1.75	0.6-2.0	0.04-0.18	4.5-6.0	Low----------	0.24			
	24-60	5-20	1.55-1.75	0.2-2.0	0.04-0.17	5.1-6.5	Low----------	0.24			
125*:											
Kinross---------	0-3	---	0.10-0.35	2.0-6.0	0.35-0.45	3.6-5.0	-------------	----	5	2	>50
	3-60	0-10	1.40-1.70	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
Dawson----------	0-6	---	0.15-0.30	>6.0	0.55-0.65	3.6-4.4	-------------	----	4	7	65-85
	6-30	---	0.15-0.40	0.2-6.0	0.35-0.45	3.6-4.4	-------------	----			
	30-60	0-10	1.55-1.75	6.0-20	0.03-0.10	4.5-6.5	Low----------	0.15			
127B*, 127D*, 127E*:											
Keweenaw--------	0-2	2-15	1.35-1.60	2.0-6.0	0.07-0.10	4.5-6.5	Low----------	0.10	5	8	.5-2
	2-25	2-15	1.45-1.80	2.0-6.0	0.08-0.11	4.5-6.5	Low----------	0.17			
	25-47	0-15	1.50-1.80	0.6-6.0	0.06-0.14	4.5-6.5	Low----------	0.17			
	47-60	2-15	1.50-1.70	2.0-6.0	0.04-0.10	5.1-6.5	Low----------	0.17			
Kalkaska--------	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low----------	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low----------	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
130B*:											
Munising	0-12	5-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low	0.17	4	2	1-3
	12-25	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low	0.24			
	48-60	10-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low	0.24			
Alcona	0-6	2-15	1.30-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low	0.17	5	2	1-3
	6-19	5-20	1.35-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low	0.17			
	19-48	5-18	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low	0.17			
	48-60	5-18	1.35-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low	0.24			
Liminga	0-10	0-10	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-2
	10-39	0-10	1.30-1.60	6.0-20	0.06-0.08	4.5-6.5	Low	0.15			
	39-60	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-6.5	Low	0.15			
130D*, 130F*:											
Munising	0-12	2-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low	0.17	4	2	1-3
	12-25	2-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low	0.24			
	48-60	5-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low	0.24			
Alcona	0-6	2-15	1.30-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low	0.17	5	2	1-3
	6-19	5-20	1.35-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low	0.17			
	19-48	5-18	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low	0.17			
	48-60	5-18	1.35-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low	0.24			
Liminga	0-10	0-10	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-2
	10-39	0-10	1.30-1.60	6.0-20	0.06-0.08	4.5-6.5	Low	0.15			
	39-60	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-6.5	Low	0.15			
131B*:											
Graveraet	0-2	7-18	1.30-1.60	0.6-2.0	0.17-0.22	4.5-6.5	Low	0.37	3	5	1-3
	2-21	5-18	1.35-1.65	0.6-2.0	0.14-0.20	5.1-6.5	Low	0.43			
	21-39	5-18	1.80-2.00	<0.06	0.03-0.05	5.1-6.5	Low	0.32			
	39-60	5-18	1.60-1.80	0.2-2.0	0.03-0.05	6.6-8.4	Low	0.37			
Misery	0-7	10-20	1.35-1.50	0.6-2.0	0.17-0.20	3.6-6.5	Low	0.37	3	3	1-3
	7-11	10-20	1.45-1.70	0.6-2.0	0.17-0.20	4.5-6.5	Low	0.43			
	11-38	12-25	1.80-2.00	<0.06	0.03-0.05	5.1-7.8	Low	0.32			
	38-60	10-25	1.60-1.80	0.2-2.0	0.03-0.05	6.6-8.4	Low	0.37			
132B*, 132D*, 132F*:											
Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
Alcona	0-6	2-15	1.30-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low	0.17	5	2	1-3
	6-19	5-20	1.35-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low	0.17			
	19-48	5-18	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low	0.17			
	48-60	5-18	1.35-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low	0.24			
133B*, 133D*, 133E*:											
Liminga	0-10	0-10	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-2
	10-39	0-10	1.30-1.60	6.0-20	0.06-0.08	4.5-6.5	Low	0.15			
	39-60	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-6.5	Low	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
133B*, 133D*, 133E*:											
Alcona----------	0-6	2-15	1.30-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low-----------	0.17	5	2	1-3
	6-19	5-20	1.35-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low-----------	0.17			
	19-48	5-18	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low-----------	0.17			
	48-60	5-18	1.35-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low-----------	0.24			
134A*:											
Halfaday--------	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	4.5-6.5	Low-----------	0.15	5	1	.5-2
	3-60	0-10	1.35-1.50	6.0-20	0.06-0.08	4.5-6.5	Low-----------	0.15			
Au Gres---------	0-19	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low-----------	0.15	5	1	.5-8
	19-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low-----------	0.15			
135D*:											
Deer Park-------	0-4	0-10	1.30-1.55	6.0-20	0.04-0.07	5.1-6.0	Low-----------	0.15	5	1	.5-1
	4-23	0-10	1.40-1.60	6.0-20	0.03-0.06	5.1-6.5	Low-----------	0.15			
	23-60	0-10	1.40-1.55	6.0-20	0.03-0.05	5.1-6.5	Low-----------	0.15			
Kinross---------	0-3	---	0.10-0.35	2.0-6.0	0.35-0.45	3.6-5.0	--------------	-----	5	2	>50
	3-60	0-10	1.40-1.70	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
136B*:											
Michigamme------	0-4	1-10	1.15-1.65	0.6-2.0	0.06-0.18	3.6-6.5	Low-----------	0.28	4	8	1-3
	4-12	1-15	1.25-1.80	0.6-2.0	0.06-0.22	3.6-6.5	Low-----------	0.28			
	12-29	1-10	1.30-1.85	0.6-2.0	0.05-0.16	3.6-6.5	Low-----------	0.20			
	29-33	---	---	---	---	---	--------------	-----			
Net-------------	0-5	2-12	1.30-1.70	0.6-2.0	0.13-0.20	3.6-6.0	Low-----------	0.28	4	8	2-6
	5-16	2-12	1.40-1.65	0.6-2.0	0.06-0.21	3.6-6.0	Low-----------	0.28			
	16-36	2-10	1.75-2.05	<0.06	0.01-0.02	3.6-6.0	Low-----------	0.20			
	36-60	2-10	1.30-1.70	0.6-6.0	0.01-0.02	5.1-6.5	Low-----------	0.20			
137A*:											
Sturgeon--------	0-8	2-15	1.40-1.65	0.6-2.0	0.22-0.24	4.5-6.5	Low-----------	0.37	4	5	2-3
	8-34	5-18	1.50-1.70	0.6-2.0	0.10-0.22	4.5-6.5	Low-----------	0.28			
	34-60	0-10	1.50-1.65	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
Arnheim---------	0-4	12-18	1.15-1.60	0.6-6.0	0.12-0.35	5.1-7.3	Low-----------	0.37	5	8	2-4
	4-60	5-18	1.50-1.80	0.6-2.0	0.05-0.22	5.1-7.3	Low-----------	0.37			
Pelkie----------	0-7	5-12	1.30-1.55	6.0-20	0.08-0.12	4.5-6.5	Low-----------	0.17	5	2	1-2
	7-60	0-10	1.25-1.65	6.0-20	0.05-0.09	4.5-6.5	Low-----------	0.15			
138-------------- Bergland	0-5	---	0.10-0.20	0.2-6.0	0.35-0.45	5.1-7.8	--------------	-----	3	2	>75
	5-20	50-70	1.30-1.50	<0.06	0.09-0.13	5.1-7.8	High----------	0.28			
	20-60	50-70	1.40-1.50	<0.06	0.08-0.12	7.4-8.4	High----------	0.28			
139B*, 139D*, 139E*, 140B*, 140D*, 140E*:											
Trimountain----	0-4	2-12	1.30-1.60	0.6-2.0	0.10-0.20	3.6-6.0	Low-----------	0.17	3	8	1-3
	4-26	2-12	1.35-1.65	0.6-2.0	0.10-0.17	3.6-6.0	Low-----------	0.17			
	26-45	2-12	1.80-2.30	<0.06	0.01-0.04	3.6-6.0	Low-----------	0.17			
	45-60	0-12	1.55-2.00	0.6-6.0	0.01-0.04	4.5-6.5	Low-----------	0.10			
Paavola--------	0-4	2-12	1.30-1.60	2.0-20	0.09-0.11	4.5-6.0	Low-----------	0.17	4	8	1-3
	4-29	2-10	1.30-1.70	0.06-0.2	0.01-0.04	4.5-6.5	Low-----------	0.10			
	29-57	2-12	1.80-2.10	<0.06	0.01-0.04	4.5-6.0	Low-----------	0.17			
	57-60	2-12	1.70-2.10	<0.06	0.01-0.04	4.5-6.5	Low-----------	0.17			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
139B*, 139D*, 139E*, 140B*, 140D*, 140E*:											
Waiska	0-6	0-5	1.35-1.45	6.0-20	0.02-0.04	4.5-6.0	Low	0.15	2	1	.5-1
	6-11	2-12	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low	0.10			
	11-60	0-5	1.45-1.60	>20	0.01-0.03	4.5-6.0	Low	0.10			
142F*:											
Keweenaw	0-2	2-15	1.35-1.60	2.0-6.0	0.07-0.10	4.5-6.5	Low	0.10	5	8	.5-2
	2-25	2-15	1.45-1.80	2.0-6.0	0.08-0.11	4.5-6.5	Low	0.17			
	25-47	0-15	1.50-1.80	0.6-6.0	0.06-0.14	4.5-6.5	Low	0.17			
	47-60	2-15	1.50-1.70	2.0-6.0	0.04-0.10	5.1-6.5	Low	0.17			
Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
Waiska	0-6	0-5	1.35-1.45	6.0-20	0.02-0.04	4.5-6.0	Low	0.15	2	1	.5-1
	6-11	2-12	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low	0.10			
	11-60	0-5	1.45-1.60	>20	0.01-0.03	4.5-6.0	Low	0.10			
144F*:											
Graveraet	0-2	7-18	1.30-1.60	0.6-2.0	0.17-0.22	4.5-6.5	Low	0.37	3	5	1-3
	2-21	5-18	1.35-1.65	0.6-2.0	0.14-0.20	5.1-6.5	Low	0.43			
	21-39	5-18	1.80-2.00	<0.06	0.03-0.05	5.1-6.5	Low	0.32			
	39-60	5-18	1.60-1.80	0.2-2.0	0.03-0.05	6.6-8.4	Low	0.37			
Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
145B*:											
Kalkaska	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
Halfaday	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	4.5-6.5	Low	0.15	5	1	.5-2
	3-60	0-10	1.35-1.50	6.0-20	0.06-0.08	4.5-6.5	Low	0.15			
146*:											
Cathro	0-20	---	0.28-0.45	0.2-6.0	0.45-0.55	4.5-7.8	-------------	----	5	2	60-85
	20-46	---	0.15-0.30	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----			
	46-60	10-25	1.50-1.70	0.2-2.0	0.11-0.22	5.6-8.4	Low	0.37			
Gay	0-5	---	0.30-0.40	0.6-2.0	0.35-0.45	5.1-6.5	-------------	----	5	2	>25
	5-16	5-15	1.15-1.60	0.6-2.0	0.07-0.14	5.1-6.5	Low	0.24			
	16-24	5-18	1.30-1.80	0.6-2.0	0.10-0.18	5.1-6.5	Low	0.24			
	24-60	10-25	1.80-1.95	0.6-2.0	0.09-0.17	5.6-7.3	Low	0.24			
147B*:											
Munising	0-12	5-10	1.25-1.65	2.0-6.0	0.08-0.12	4.5-6.0	Low	0.17	4	2	1-3
	12-25	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low	0.24			
	25-48	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low	0.24			
	48-60	10-25	1.40-1.65	0.2-2.0	0.02-0.04	4.5-6.5	Low	0.24			
Liminga	0-10	0-10	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-2
	10-39	0-10	1.30-1.60	6.0-20	0.06-0.08	4.5-6.5	Low	0.15			
	39-60	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-6.5	Low	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
147B*:											
Alcona----------	0-6	2-15	1.10-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low-----------	0.17	5	2	1-3
	6-19	5-20	1.25-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low-----------	0.17			
	19-48	5-18	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low-----------	0.17			
	48-60	5-18	1.50-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low-----------	0.24			
148B*:											
Graveraet-------	0-2	7-18	1.30-1.60	0.6-2.0	0.17-0.22	4.5-6.5	Low-----------	0.37	3	5	1-3
	2-21	5-18	1.35-1.65	0.6-2.0	0.14-0.20	5.1-6.5	Low-----------	0.43			
	21-39	5-18	1.80-2.00	<0.06	0.03-0.05	5.1-6.5	Low-----------	0.32			
	39-60	5-18	1.60-1.80	0.2-2.0	0.03-0.05	6.6-8.4	Low-----------	0.37			
Ocqueoc---------	0-4	0-10	1.30-1.60	6.0-20	0.07-0.09	4.5-6.5	Low-----------	0.15	5	1	1-3
	4-28	0-15	1.30-1.60	6.0-20	0.06-0.12	4.5-6.5	Low-----------	0.15			
	28-60	10-27	1.50-1.80	0.2-0.6	0.05-0.21	5.6-7.8	Moderate-----	0.15			
Kalkaska--------	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low-----------	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low-----------	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
148D*:											
Graveraet-------	0-2	7-18	1.30-1.60	0.6-2.0	0.17-0.22	4.5-6.5	Low-----------	0.37	3	5	1-3
	2-21	5-18	1.35-1.65	0.6-2.0	0.14-0.20	5.1-6.5	Low-----------	0.43			
	21-39	5-18	1.80-2.00	<0.06	0.03-0.05	5.1-6.5	Low-----------	0.32			
	39-60	5-18	1.60-1.80	0.2-2.0	0.03-0.05	6.6-8.4	Low-----------	0.37			
Ocqueoc---------	0-4	0-10	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low-----------	0.15	4	1	1-3
	4-28	0-10	1.15-1.60	6.0-20	0.06-0.12	4.5-6.5	Low-----------	0.15			
	28-60	10-27	1.50-1.90	0.2-0.6	0.05-0.21	5.6-7.8	Low-----------	0.37			
Kalkaska--------	0-3	0-10	1.25-1.45	6.0-20	0.05-0.09	3.6-6.0	Low-----------	0.15	5	1	1-4
	3-28	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low-----------	0.15			
	28-60	0-10	1.35-1.50	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
150B*:											
Richter---------	0-5	8-18	1.20-1.50	2.0-6.0	0.20-0.22	5.6-7.3	Low-----------	0.37	4	3	2-3
	5-24	5-18	1.35-1.60	2.0-6.0	0.14-0.19	5.6-7.3	Low-----------	0.43			
	24-41	5-20	1.35-1.60	2.0-6.0	0.13-0.22	5.6-7.3	Low-----------	0.43			
	41-60	2-12	1.50-1.65	2.0-6.0	0.06-0.10	7.4-8.4	Low-----------	0.17			
Alcona----------	0-6	2-15	1.10-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low-----------	0.17	5	2	1-3
	6-19	5-20	1.25-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low-----------	0.17			
	19-48	5-18	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low-----------	0.17			
	48-60	5-18	1.50-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low-----------	0.24			
151B------------- Champion	0-4	2-10	1.20-1.35	0.6-2.0	0.11-0.18	3.6-6.0	Low-----------	0.28	4	8	1-3
	4-18	2-15	1.25-1.65	0.6-2.0	0.10-0.20	3.6-6.0	Low-----------	0.28			
	18-49	2-12	1.75-2.00	<0.06	0.01-0.04	3.6-6.0	Low-----------	0.20			
	49-60	1-12	1.30-1.65	0.6-6.0	0.01-0.04	3.6-6.0	Low-----------	0.20			
152B------------- Kallio	0-5	2-12	1.30-1.60	0.6-2.0	0.13-0.17	3.6-5.5	Low-----------	0.28	3	8	1-3
	5-22	2-12	1.25-1.60	0.6-2.0	0.12-0.22	3.6-6.5	Low-----------	0.43			
	22-36	5-30	1.75-2.05	<0.06	0.03-0.05	3.6-6.5	Low-----------	0.43			
	36-60	10-35	1.35-1.90	0.2-0.6	0.03-0.05	5.6-7.3	Low-----------	0.43			
153B*, 153D*:											
Champion--------	0-4	2-10	1.20-1.35	0.6-2.0	0.11-0.18	3.6-6.0	Low-----------	0.28	4	8	1-3
	4-18	2-15	1.25-1.65	0.6-2.0	0.10-0.20	3.6-6.0	Low-----------	0.28			
	18-49	2-12	1.75-2.00	<0.06	0.01-0.04	3.6-6.0	Low-----------	0.20			
	49-60	1-12	1.30-1.65	0.6-6.0	0.01-0.04	3.6-6.0	Low-----------	0.20			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
153B*, 153D*:											
Karlin----------	0-3	12-15	1.35-1.60	2.0-6.0	0.15-0.17	3.6-6.5	Low----------	0.24	4	3	.5-2
	3-21	2-15	1.35-1.60	2.0-6.0	0.08-0.16	3.6-6.5	Low----------	0.17			
	21-34	0-15	1.40-1.65	6.0-20	0.03-0.08	4.5-6.5	Low----------	0.17			
	34-60	0-10	1.40-1.70	6.0-20	0.03-0.04	5.6-7.3	Low----------	0.15			
Fence-----------	0-2	5-15	1.20-1.35	0.6-2.0	0.20-0.22	3.6-6.5	Low----------	0.37	5	3	1-2
	2-13	5-18	1.50-1.60	0.2-0.6	0.11-0.22	3.6-6.5	Low----------	0.37			
	13-42	8-18	1.50-1.60	0.2-0.6	0.17-0.22	3.6-6.5	Low----------	0.37			
	42-60	5-15	1.50-1.60	0.2-0.6	0.17-0.22	4.5-7.8	Low----------	0.37			
153E*:											
Champion--------	0-4	2-10	1.10-1.35	0.6-2.0	0.11-0.18	3.6-6.0	Low----------	0.28	4	8	1-3
	4-18	2-15	1.25-1.60	0.6-2.0	0.10-0.20	3.6-6.0	Low----------	0.28			
	18-49	2-12	1.80-2.05	<0.06	0.01-0.04	3.6-6.0	Low----------	0.20			
	49-60	1-12	1.40-1.70	0.6-6.0	0.01-0.04	3.6-6.0	Low----------	0.20			
Karlin----------	0-3	12-15	1.35-1.60	2.0-6.0	0.15-0.17	3.6-6.5	Low----------	0.24	4	3	.5-2
	3-25	2-15	1.35-1.60	2.0-6.0	0.08-0.16	3.6-6.5	Low----------	0.17			
	25-30	0-15	1.40-1.65	6.0-20	0.03-0.08	4.5-6.5	Low----------	0.17			
	30-60	0-10	1.40-1.70	6.0-20	0.03-0.04	5.6-7.3	Low----------	0.15			
Fence-----------	0-2	5-15	1.20-1.35	0.6-2.0	0.20-0.22	3.6-6.5	Low----------	0.37	5	3	1-2
	2-13	5-18	1.50-1.60	0.2-0.6	0.11-0.22	3.6-6.5	Low----------	0.37			
	13-42	8-18	1.50-1.60	0.2-0.6	0.17-0.22	3.6-6.5	Low----------	0.37			
	42-60	5-15	1.50-1.60	0.2-0.6	0.17-0.22	4.5-7.8	Low----------	0.37			
154B*, 154E*:											
Vilas-----------	0-2	2-6	1.35-1.65	6.0-20	0.09-0.12	4.5-6.5	Low----------	0.17	5	2	<1
	2-19	2-6	1.50-1.65	6.0-20	0.07-0.12	4.5-6.5	Low----------	0.17			
	19-35	1-3	1.50-1.70	6.0-20	0.05-0.08	4.5-6.5	Low----------	0.17			
	35-60	0-3	1.50-1.70	6.0-20	0.04-0.07	5.1-6.5	Low----------	0.17			
Rubicon---------	0-4	0-5	1.35-1.55	6.0-20	0.05-0.09	4.5-6.0	Low----------	0.15	5	1	.5-1
	4-60	0-10	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low----------	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "occasional," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Subsidence: Initial	Subsidence: Total	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In		In	In		
10B, 10D Munising	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Low	High.
10E Munising	B	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
11A Skanee	C	None	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate	High.
12 Gay	B/D	None	---	---	+1-0.5	Apparent	Nov-Jun	>60	---	---	---	High	Moderate.
14A Assinins	B	None	---	---	0.5-1.0	Apparent	Nov-May	>60	---	---	---	Moderate	Moderate.
15B, 15D, 15E Kalkaska	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
16B, 16D Rubicon	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
17A Croswell	A	None	---	---	2.0-4.0	Apparent	Nov-May	>60	---	---	---	Low	Moderate.
18A Au Gres	B	None	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	---	Low	Moderate.
21B*, 21D*:													
Keweenaw	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Moderate.
Kalkaska	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
22B*:													
Abbaye	B	None	---	---	1.0-2.0	Perched	Nov-May	20-40	Hard	---	---	Low	Moderate.
Munising	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Low	High.
23A*:													
Zeba	B	None	---	---	0.5-1.5	Apparent	Nov-May	20-40	Hard	---	---	Moderate	Moderate.
Jacobsville	D	None	---	---	+.5-1.0	Apparent	Nov-May	20-40	Hard	---	---	High	High.
24B Deerton	A	None	---	---	>6.0	---	---	20-40	Hard	---	---	Low	High.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Ini-tial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
25*:													
Lupton-----------	A/D	None--------	---	---	+1-1.0	Apparent	Sep-May	>60	---	---	50-55	High-----	Low.
Cathro-----------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	---	15-22	High-----	Low.
26*:													
Dawson-----------	A/D	None--------	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	15-36	High-----	High.
Loxley-----------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	>60	---	---	50-55	High-----	High.
27*:													
Histosols.													
Aquents.													
29B-------------- Waiska	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
30B*:													
Munising---------	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Low------	High.
Skanee-----------	C	None--------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate-	High.
31A*:													
Skanee-----------	C	None--------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate-	High.
Gay--------------	B/D	None--------	---	---	+1-0.5	Apparent	Nov-Jun	>60	---	---	---	High-----	Moderate.
32B-------------- Alcona	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Low.
33B*, 33D*:													
Munising---------	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Low------	High.
Yalmer-----------	B	None--------	---	---	1.5-2.0	Perched	Mar-May	>60	---	---	---	Low------	Moderate.
34B-------------- Munising	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Low------	High.
34D, 34E--------- Munising	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
35B, 35D--------- Graveraet	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.
35E-------------- Graveraet	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Ini-tial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
36A--------------- Sturgeon	B	Occasional--	Brief-----	Mar-May	0.5-1.5	Apparent	Nov-May	>60	---	---	---	Moderate-	Moderate.
37---------------- Arnheim	D	Occasional--	Brief-----	Nov-May	0-1.0	Apparent	Nov-May	>60	---	---	---	High-----	Moderate.
38A--------------- Pelkie	A	Occasional--	Brief-----	Mar-May	2.5-5.0	Apparent	Nov-May	>60	---	---	---	Low------	Moderate.
41A--------------- Misery	C	None--------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	High-----	Moderate.
45*. Pits, borrow													
46B*, 46D*: Karlin-----------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
Kalkaska---------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
47B*: Ocqueoc----------	B	None--------	---	---	2.5-6.0	Apparent	Nov-Apr	>60	---	---	---	Low------	Moderate.
Halfaday---------	A	None--------	---	---	2.0-3.5	Apparent	Nov-Apr	>60	---	---	---	Low------	High.
51A*: Allendale--------	B	None--------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	---	---	High-----	Moderate.
Rudyard----------	D	None--------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	High-----	Low.
52B--------------- Allouez	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
55*. Dumps, mine													
56---------------- Jacobsville	D	None--------	---	---	+.5-1.0	Apparent	Nov-May	20-40	Hard	---	---	High-----	High.
58B*: Manistee---------	A	None--------	---	---	2.5-4.0	Perched	Dec-Apr	>60	---	---	---	High-----	Moderate.
Ontonagon--------	D	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Moderate.
59B*: Graveraet--------	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.
Ocqueoc----------	B	None--------	---	---	2.5-6.0	Apparent	Nov-Apr	>60	---	---	---	Low------	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hard-ness	Subsidence: Ini-tial	Subsidence: Total	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In		In	In		
59B*:													
Kalkaska----------	A	None---------	---	---	>6.0	---	---	>60	---	---	---	Low-------	High.
60B*:													
Nunica------------	C	None---------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Low.
Fence-------------	B	None---------	---	---	2.0-6.0	Perched	Nov-May	>60	---	---	---	Low-------	High.
60D*, 60E*:													
Nunica------------	C	None---------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Low.
Fence-------------	B	None---------	---	---	>6.0	---	---	>60	---	---	---	Low-------	High.
61B, 61D, 61E------ Ontonagon	D	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	Moderate.
65A---------------- Rudyard	D	None---------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	High------	Low.
66B*:													
Munising----------	B	None---------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Low-------	High.
Abbaye------------	B	None---------	---	---	1.0-2.0	Perched	Nov-May	20-40	Hard	---	---	Low-------	Moderate.
Kalkaska----------	A	None---------	---	---	>6.0	---	---	>60	---	---	---	Low-------	High.
66D*, 66F*:													
Munising----------	B	None---------	---	---	>6.0	---	---	>60	---	---	---	Low-------	High.
Abbaye------------	B	None---------	---	---	>6.0	---	---	20-40	Hard	---	---	Low-------	Moderate.
Kalkaska----------	A	None---------	---	---	>6.0	---	---	>60	---	---	---	Low-------	High.
67----------------- Roscommon	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	---	High------	Low.
68*. Dumps, stamp sand													
69B*:													
Watton------------	C	None---------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Low.
Alstad------------	C	None---------	---	---	1.0-3.0	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.
70B---------------- Watton	C	None---------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Low.
71A---------------- Richter	B	None---------	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	---	High------	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Initial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
72A--------------- Halfaday	A	None--------	---	---	2.0-3.5	Apparent	Nov-Apr	>60	---	---	---	Low------	High.
73B*:													
Froberg----------	D	None--------	---	---	3.0-6.0	Apparent	Nov-May	>60	---	---	---	High-----	Moderate.
Rudyard----------	D	None--------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	High-----	Low.
75A*:													
Croswell---------	A	None--------	---	---	2.0-4.0	Apparent	Nov-May	>60	---	---	---	Low------	Moderate.
Au Gres----------	B	None--------	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	---	Low------	Moderate.
76A*:													
Au Gres----------	B	None--------	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	---	Low------	Moderate.
Kinross----------	A/D	None--------	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	---	High-----	Moderate.
77*:													
Tawas------------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	>60	---	---	15-30	High-----	Moderate.
Roscommon--------	A/D	None--------	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	---	High-----	Low.
78B--------------- Deer Park	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Low.
79B*:													
Yalmer-----------	B	None--------	---	---	1.5-2.0	Perched	Mar-May	>60	---	---	---	Low------	Moderate.
Assinins---------	B	None--------	---	---	0.5-1.0	Apparent	Nov-May	>60	---	---	---	Moderate-	Moderate.
83*:													
Udipsamments.													
Udorthents.													
84B--------------- Graveraet	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.
84D, 84E---------- Graveraet	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Moderate.
86B, 86D---------- Trimountain	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	High.
86E--------------- Trimountain	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	High.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Initial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
89B*, 89D*:													
Trimountain------	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	High.
Paavola----------	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.
89E*:													
Trimountain------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	High.
Paavola----------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Moderate.
90---------------- Witbeck	B/D	None--------	---	---	+.5-1.0	Apparent	Nov-Jun	>60	---	---	---	High-----	Moderate.
92B*, 92D*:													
Arcadian---------	D	None--------	---	---	>6.0	---	---	10-20	Hard	---	---	Low------	Moderate.
Michigamme-------	C	None--------	---	---	1.0-2.0	Perched	Nov-May	20-40	Hard	---	---	Low------	High.
Rock outcrop.													
92E*:													
Arcadian---------	D	None--------	---	---	>6.0	---	---	10-20	Hard	---	---	Low------	Moderate.
Michigamme-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	---	Low------	High.
Rock outcrop.													
95A*:													
Assinins---------	B	None--------	---	---	0.5-1.0	Apparent	Nov-May	>60	---	---	---	Moderate-	Moderate.
Skanee-----------	C	None--------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate-	High.
96B, 96D, 96E, 96F-------------- Liminga	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
98B*:													
Munising---------	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Low------	High.
Yalmer-----------	B	None--------	---	---	1.5-2.0	Perched	Mar-May	>60	---	---	---	Low------	Moderate.
98D*, 98E*:													
Munising---------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
Yalmer-----------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
100A*:													
Au Gres----------	B	None--------	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	---	Low------	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Ini-tial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
100A*:													
Roscommon--------	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	---	High-----	Low.
101A--------------- Net	C	None---------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.
102A*:													
Net---------------	C	None---------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.
Witbeck-----------	B/D	None---------	---	---	+.5-1.0	Apparent	Nov-Jun	>60	---	---	---	High-----	Moderate.
103B*:													
Trimountain------	B	None---------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	High.
Net---------------	C	None---------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.
104D*:													
Urban land.													
Udorthents.													
106B*, 106D*, 106E*:													
Urban land.													
Udorthents.													
Udipsamments.													
107B*, 107D*, 107E*:													
Kalkaska---------	A	None---------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
Waiska-----------	A	None---------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
108B--------------- Freda	D	None---------	---	---	>6.0	---	---	10-20	Hard	---	---	Low------	Moderate.
110D*, 110E*:													
Kalkaska----------	A	None---------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
Waiska------------	A	None---------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
115B*:													
Trimountain------	B	None---------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	High.
Paavola----------	B	None---------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Ini-tial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
115D*, 115E*:													
Trimountain	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	High.
Paavola	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	Moderate.
116B*:													
Trimountain	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate	High.
Paavola	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate	Moderate.
Michigamme	C	None	---	---	1.0-2.0	Perched	Nov-May	20-40	Hard	---	---	Low	High.
116D*, 116E*:													
Trimountain	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	High.
Paavola	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	Moderate.
Michigamme	C	None	---	---	>6.0	---	---	20-40	Hard	---	---	Low	High.
119A*:													
Net	C	None	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate	Moderate.
Witbeck	B/D	None	---	---	+.5-1.0	Apparent	Nov-Jun	>60	---	---	---	High	Moderate.
125*:													
Kinross	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	---	High	Moderate.
Dawson	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	15-36	High	High.
127B*, 127D*, 127E*:													
Keweenaw	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Moderate.
Kalkaska	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
130B*:													
Munising	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Low	High.
Alcona	B	None	---	---	>6.0	---	---	>60	---	---	---	Low	Low.
Liminga	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Moderate.
130D*, 130F*:													
Munising	B	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
Alcona	B	None	---	---	>6.0	---	---	>60	---	---	---	Low	Low.
Liminga	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Ini-tial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
131B*:													
Graveraet	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate	Moderate.
Misery	C	None	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	High	Moderate.
132B*, 132D*, 132F*:													
Kalkaska	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
Alcona	B	None	---	---	>6.0	---	---	>60	---	---	---	Low	Low.
133B*, 133D*, 133E*:													
Liminga	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Moderate.
Alcona	B	None	---	---	>6.0	---	---	>60	---	---	---	Low	Low.
134A*:													
Halfaday	A	None	---	---	2.0-3.5	Apparent	Nov-Apr	>60	---	---	---	Low	High.
Au Gres	B	None	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	---	Low	Moderate.
135D*:													
Deer Park	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Low.
Kinross	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	---	High	Moderate.
136B*:													
Michigamme	C	None	---	---	1.0-2.0	Perched	Nov-May	20-40	Hard	---	---	Low	High.
Net	C	None	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate	Moderate.
137A*:													
Sturgeon	B	Occasional	Brief	Mar-May	0.5-1.5	Apparent	Nov-May	>60	---	---	---	Moderate	Moderate.
Arnheim	D	Occasional	Brief	Nov-May	0-1.0	Apparent	Nov-May	>60	---	---	---	High	Moderate.
Pelkie	A	Occasional	Brief	Mar-May	2.5-5.0	Apparent	Nov-May	>60	---	---	---	Low	Moderate.
138 Bergland	D	None	---	---	+1-1.0	Perched	Nov-Jun	>60	---	---	---	High	Low.
139B*, 139D*:													
Trimountain	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate	High.
Paavola	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate	Moderate.
Waiska	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Ini-tial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
139E*:													
Trimountain------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	High.
Paavola----------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Moderate.
Waiska-----------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
140B*:													
Trimountain------	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	High.
Paavola----------	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate-	Moderate.
Waiska-----------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
140D*, 140E*:													
Trimountain------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	High.
Paavola----------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Moderate.
Waiska-----------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
142F*:													
Keweenaw---------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
Kalkaska---------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
Waiska-----------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
144F*:													
Graveraet--------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate-	Moderate.
Kalkaska---------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
145B*:													
Kalkaska---------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
Halfaday---------	A	None--------	---	---	2.0-3.5	Apparent	Nov-Apr	>60	---	---	---	Low------	High.
146*:													
Cathro-----------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	---	15-22	High-----	Low.
Gay--------------	B/D	None--------	---	---	+1-0.5	Apparent	Nov-Jun	>60	---	---	---	High-----	Moderate.
147B*:													
Munising---------	B	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Low------	High.
Liminga----------	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	Moderate.
Alcona-----------	B	None--------	---	---	2.5-6.0	Perched	Sep-May	>60	---	---	---	Moderate-	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Ini-tial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
148B*:													
Graveraet	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate	Moderate.
Ocqueoc	B	None	---	---	2.5-6.0	Apparent	Nov-Apr	>60	---	---	---	Low	Moderate.
Kalkaska	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
148D*:													
Graveraet	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	Moderate.
Ocqueoc	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Moderate.
Kalkaska	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
150B*:													
Richter	B	None	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	---	High	Moderate.
Alcona	B	None	---	---	2.5-6.0	Perched	Sep-May	>60	---	---	---	Moderate	Low.
151B Champion	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate	High.
152B Kallio	C	None	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	---	Moderate	Moderate.
153B*, 153D*:													
Champion	B	None	---	---	1.0-2.0	Perched	Nov-May	>60	---	---	---	Moderate	High.
Karlin	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
Fence	B	None	---	---	2.0-6.0	Perched	Nov-May	>60	---	---	---	Low	High.
153E*:													
Champion	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	High.
Karlin	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
Fence	B	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
154B*, 154E*:													
Vilas	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
Rubicon	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Abbaye	Coarse-loamy, mixed, frigid Alfic Haplorthods
Alcona	Coarse-loamy, mixed, frigid Alfic Haplorthods
Allendale	Sandy over clayey, mixed, frigid Alfic Haplaquods
Allouez	Sandy-skeletal, mixed, frigid Typic Haplumbrepts
Alstad	Fine-loamy, mixed Glossaquic Eutroboralfs
Aquents	Mixed, nonacid, frigid Aquents
Arcadian	Loamy-skeletal, mixed, frigid Lithic Haplumbrepts
Arnheim	Coarse-loamy, mixed, nonacid, frigid Typic Fluvaquents
*Assinins	Coarse-loamy, mixed, frigid Alfic Haplaquods
Au Gres	Sandy, mixed, frigid Entic Haplaquods
Bergland	Very fine, mixed, nonacid, frigid Typic Haplaquepts
Cathro	Loamy, mixed, euic Terric Borosaprists
Champion	Coarse-loamy, mixed, frigid Typic Fragiorthods
Croswell	Sandy, mixed, frigid Entic Haplorthods
Dawson	Sandy or sandy-skeletal, mixed, dysic Terric Borosaprists
Deer Park	Mixed, frigid Spodic Udipsamments
Deerton	Sandy, mixed, frigid Entic Haplorthods
Fence	Coarse-silty, mixed, frigid Alfic Haplorthods
Freda	Loamy, mixed, frigid Lithic Haplorthods
Froberg	Clayey over loamy, mixed Typic Eutroboralfs
Gay	Coarse-loamy, mixed, nonacid, frigid Typic Haplaquepts
Graveraet	Coarse-loamy, mixed, frigid Alfic Fragiorthods
Halfaday	Sandy, mixed, frigid Typic Haplorthods
Histosols	Euic, frigid Histosols
Jacobsville	Coarse-loamy, mixed, nonacid, frigid Typic Haplaquepts
Kalkaska	Sandy, mixed, frigid Typic Haplorthods
Kallio	Coarse-loamy, mixed, frigid Alfic Fragiorthods
*Karlin	Sandy, mixed, frigid Entic Haplorthods
Keweenaw	Sandy, mixed, frigid Alfic Haplorthods
Kinross	Sandy, mixed, frigid Typic Haplaquods
Liminga	Sandy, mixed, frigid Typic Haplorthods
Loxley	Dysic Typic Borosaprists
Lupton	Euic Typic Borosaprists
Manistee	Sandy over clayey, mixed, frigid Alfic Haplorthods
Michigamme	Coarse-loamy, mixed, frigid Typic Haplorthods
Misery	Coarse-loamy, mixed, frigid Alfic Fragiaquods
Munising	Coarse-loamy, mixed, frigid Alfic Fragiorthods
Net	Coarse-loamy, mixed, frigid Typic Fragiaquods
*Nunica	Fine-silty, mixed Eutric Glossoboralfs
*Ocqueoc	Sandy over loamy, mixed, frigid Entic Haplorthods
Ontonagon	Very fine, mixed Glossic Eutroboralfs
Paavola	Sandy-skeletal, mixed, frigid Alfic Fragiorthods
Pelkie	Mixed, frigid Typic Udipsamments
Richter	Coarse-loamy, mixed, frigid Alfic Haplaquods
*Roscommon	Mixed, frigid Mollic Psammaquents
Rubicon	Sandy, mixed, frigid Entic Haplorthods
Rudyard	Very fine, illitic Aquic Eutroboralfs
Skanee	Coarse-loamy, mixed, frigid Alfic Fragiaquods
Sturgeon	Coarse-silty over sandy or sandy-skeletal, mixed, nonacid, frigid Aquic Udifluvents
Tawas	Sandy or sandy-skeletal, mixed, euic Terric Borosaprists
Trimountain	Coarse-loamy, mixed, frigid Typic Fragiorthods
Udipsamments	Mixed, frigid Udipsamments
Udorthents	Loamy, mixed, frigid Udorthents
Vilas	Sandy, mixed, frigid Entic Haplorthods
Waiska	Sandy-skeletal, mixed, frigid Typic Haplorthods
Watton	Fine-loamy, mixed Eutric Glossoboralfs
Witbeck	Coarse-loamy, mixed, nonacid, frigid Histic Humaquepts
Yalmer	Sandy, mixed, frigid Alfic Fragiorthods
Zeba	Coarse-loamy, mixed, frigid Alfic Haplaquods

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Soil name and map symbol	Land capability	Prime farmland	Habitat type: Primary	Habitat type: Secondary	Woodland ordination symbol	Michigan soil management group
10B------------------- Munising	IIe	---	ATD	TM	3W	3a-af
10D------------------- Munising	IIIe	---	ATD	TM	3W	3a-af
10E------------------- Munising	VIIe	---	ATD	TM	3R	3a-af
11A------------------- Skanee	IIw	---	TMC	---	3W	3b-af
12-------------------- Gay	Vw	---	FI	TTS	7W	3c
14A------------------- Assinins	IIIw	---	TMC	---	3W	4b
15B------------------- Kalkaska	IVs	---	ATD-D	TM	3S	5a
15D------------------- Kalkaska	VIs	---	ATD-D	TM	3S	5a
15E------------------- Kalkaska	VIIs	---	ATD-D	TM	3R	5a
16B------------------- Rubicon	VIs	---	AQVac	TMV	4S	5.3a
16D------------------- Rubicon	VIs	---	AQVac	TMV	4S	5.3a
17A------------------- Croswell	IVs	---	TMV	QAE	5S	5a
18A------------------- Au Gres	IVw	---	TMC	TMC-Vac	6W	5b
21B------------------- Keweenaw------------- Kalkaska-------------	IIIe	---	ATD-D	TM	 3A 3S	 4a-a 5a
21D------------------- Keweenaw------------- Kalkaska-------------	IVe	---	ATD-D	TM	 3A 3S	 4a-a 5a
22B------------------- Abbaye--------------- Munising-------------	IIIe	---	ATD	TM	3W	 3/Ra 3a-af
23A------------------- Zeba-Jacobsville	IIIw	---	TMC-D	TMC	2W	3/Rbc
24B------------------- Deerton	IVs	---	ATD	TM	3D	4/Ra
25-------------------- Lupton--------------- Cathro---------------	VIw	---	TTS	---	 2W 5W	 Mc M/3c

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Habitat type		Woodland ordination symbol	Michigan soil management group
			Primary	Secondary		
26	VIIw	---	PCS	---	2W	
Dawson						M/4c-a
Loxley						Mc-a
27.						
Histosols						
Aquents						
29B	VIs	---	ATD	AVO	3S	Ga
Waiska						
30B	IIe	---	ATD	TMC	3W	
Munising						3a-af
Skanee						3b-af
31A	IIw	---	TMC	FI		
Skanee					3W	3b-af
Gay					7W	3c
32B	IIe	Yes	ATD	TM	3L	3a-s
Alcona						
33B	IIe	---	ATD	TM		
Munising					3W	3a-af
Yalmer					3D	4a-af
33D	IVe	---	ATD	TM		
Munising					3W	3a-af
Yalmer					3D	4a-af
34B	IIIe	---	ATD	TM	3W	3a-af
Munising						
34D	VIe	---	ATD	TM	3R	3a-af
Munising						
34E	VIIe	---	ATD	TM	3R	3a-af
Munising						
35B	IIe	---	ATD	AVO	3W	2.5a-af
Graveraet						
35D	IIIe	---	ATD	AVO	3W	2.5a-af
Graveraet						
35E	VIIe	---	ATD	AVO	3R	2.5a-af
Graveraet						
36A	IIIw	Yes*	AVO-CI	ATD-CI	3W	L-2b
Sturgeon						
37	Vw	---	FMC	FI	5W	L-2c
Arnheim						
38A	IVs	---	AVO	---	3A	L-4a
Pelkie						
41A	IIw	---	TMC	---	3W	3b-af
Misery						
45.						
Pits, borrow						

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Habitat type		Woodland ordination symbol	Michigan soil management group
			Primary	Secondary		
46B-------------------	IVs	---	ATD	TMV		
Karlin---------------					3A	4a
Kalkaska-------------					3S	5a
46D-------------------	IVe	---	ATD	TMV		
Karlin---------------					3A	4a
Kalkaska-------------					3S	5a
47B-------------------	IIIs	---	ATD-D	TMC	3S	
Ocqueoc--------------						4/2a
Halfaday-------------						5a
51A-------------------	IIIw	---	ATD	TMC		
Allendale------------					4W	4/1b
Rudyard--------------					6W	Ob
52B-------------------	VIs	---	AVO	---	3A	Ga
Allouez						
55.						
Dumps, mine						
56--------------------	Vw	---	TTS	FI	2W	3/Rbc
Jacobsville						
58B-------------------	IIIs	---	ATD	TM		
Manistee-------------					3S	4/1a
Ontonagon------------					2C	Oa
59B-------------------	IIIe	---	ATD	AVO		
Graveraet------------					3W	2.5a-af
Ocqueoc--------------					3S	4/2a
Kalkaska-------------					3S	5a
60B-------------------	IIIe	---	TTL	---	3L	
Nunica---------------						1.5a
Fence----------------						3a
60D-------------------	VIe	---	TTL	---	3R	
Nunica---------------						1.5a
Fence----------------						3a
60E-------------------	VIIe	---	TTL	---	3R	
Nunica---------------						1.5a
Fence----------------						3a
61B-------------------	IIIe	---	TTL	TM	2C	Oa
Ontonagon						
61D-------------------	IVe	---	TTL	TM	2C	Oa
Ontonagon						
61E-------------------	VIIe	---	TTL	TM	2R	Oa
Ontonagon						
65A-------------------	IIIw	---	TTP	TAM-Eq	6W	Ob
Rudyard						
66B-------------------	VIs	---	ATD	TM		
Munising-------------					3W	3a-af
Abbaye---------------					3W	3/Ra
Kalkaska-------------					3S	5a

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Habitat type: Primary	Habitat type: Secondary	Woodland ordination symbol	Michigan soil management group
66D------------------	VIe	---	ATD	TM	3R	
Munising-------------						3a-af
Abbaye---------------						3/Ra
Kalkaska-------------						5a
66F------------------	VIIe	---	ATD	TM	3R	
Munising-------------						3a-af
Abbaye---------------						3/Ra
Kalkaska-------------						5a
67------------------- Roscommon	VIw	---	TMC	TTS	6W	5c
68. Dumps, stamp sand						
69B------------------	IIe	Yes	ATD	TMC		
Watton---------------					3A	1.5a
Alstad---------------					3W	1.5b
70B------------------ Watton	IIe	Yes	ATD	AVO	3A	1.5a
71A------------------ Richter	IIw	Yes*	TMC	ATD	3W	3b-s
72A------------------ Halfaday	IIIs	---	ATD-D	TMC	3S	5a
73B------------------	IIIe	---	TTL	TTP		
Froberg--------------					3C	1a
Rudyard--------------					6W	Ob
75A------------------	IVw	---	QAE	TMC-Vac		
Croswell-------------					5S	5a
Au Gres--------------					6W	5b
76A------------------	VIw	---	TMC-Vac	PCS		
Au Gres--------------					6W	5b
Kinross--------------					2W	5c-a
77-------------------	VIw	---	TTS	FI		
Tawas----------------					5W	M/4c
Roscommon------------					6W	5c
78B------------------ Deer Park	VIIs	---	QAE	AQVac	4S	5.3a
79B------------------	IIIs	---	ATD	TMC		
Yalmer---------------					3D	4a-af
Assinins-------------					3W	4b
83. Udipsamments Udorthents						
84B------------------ Graveraet	IIIe	---	ATD	AVO	3W	2.5a-af
84D------------------ Graveraet	VIe	---	ATD	AVO	3R	2.5a-af

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Habitat type		Woodland ordination symbol	Michigan soil management group
			Primary	Secondary		
84E------------------- Graveraet	VIIe	---	ATD	AVO	3R	2.5a-af
86B------------------- Trimountain	IIIe	---	ATD	AVO	3W	3a-af
86D------------------- Trimountain	IVe	---	ATD	AVO	3W	3a-af
86E------------------- Trimountain	VIIe	---	ATD	AVO	3R	3a-af
89B-------------------	IIIe	---	ATD	AVO	3W	
Trimountain----------						3a-af
Paavola--------------						Ga/3af
89D-------------------	IVe	---	ATD	AVO	3W	
Trimountain----------						3a-af
Paavola--------------						Ga/3af
89E-------------------	VIIe	---	ATD	AVO	3R	
Trimountain----------						3a-af
Paavola--------------						Ga/3af
90-------------------- Witbeck	VIIs	---	TMC	TTS	3X	3c
92B-------------------	VIIs	---	AVO	ATD		
Arcadian-------------					3D	Ra
Michigamme-----------					3W	3/Ra
Rock outcrop.						
92D-------------------	VIIs	---	AVO	ATD		
Arcadian-------------					3D	Ra
Michigamme-----------					3W	3/Ra
Rock outcrop.						
92E-------------------	VIIs	---	AVO	ATD	3R	
Arcadian-------------						Ra
Michigamme-----------						3/Ra
Rock outcrop.						
95A-------------------	IIIw	---	TMC	---	3W	
Assinins-------------						4b
Skanee---------------						3b-af
96B------------------- Liminga	IIIs	---	ATD-D	TM	3S	4a
96D------------------- Liminga	IIIe	---	ATD-D	TM	3S	4a
96E------------------- Liminga	VIe	---	ATD-D	TM	3R	4a
96F------------------- Liminga	VIIe	---	ATD-D	TM	3R	4a
98B-------------------	IIIe	---	ATD	TM		
Munising-------------					3W	3a-af
Yalmer---------------					3D	4a-af

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Habitat type		Woodland ordination symbol	Michigan soil management group
			Primary	Secondary		
98D	VIe	---	ATD	TM	3R	
Munising						3a-af
Yalmer						4a-af
98E	VIIe	---	ATD	TM	3R	
Munising						3a-af
Yalmer						4a-af
100A	VIw	---	TMC	TTS	6W	
Au Gres						5b
Roscommon						5c
101A	VIIs	---	ATD-CI	TMC	3X	3b-af
Net						
102A	VIIs	---	TMC	FI	3X	
Net						3b-af
Witbeck						3c
103B	IVe	---	ATD	TMC		
Trimountain					3W	3a-af
Net					3X	3b-af
104D. Urban land-Udorthents						
106B, 106D, 106E. Urban land-Udorthents-Udipsamments						
107B	IVs	---	ATD-D	TM	3S	
Kalkaska						5a
Waiska						Ga
107D	VIs	---	ATD-D	TM	3S	
Kalkaska						5a
Waiska						Ga
107E	VIIs	---	ATD-D	TM	3R	
Kalkaska						5a
Waiska						Ga
108B	VIs	---	ATD	AVO	3D	Ra
Freda						
110D	VIIs	---	ATD-D	AVO	3R	
Kalkaska						5a
Waiska						Ga
110E	VIIs	---	ATD-D	AVO	3R	
Kalkaska						5a
Waiska						Ga
115B	IVe	---	ATD	AVO	3W	
Trimountain						3a-af
Paavola						Ga/3-af
115D	VIe	---	ATD	AVO	3R	
Trimountain						3a-af
Paavola						Ga/3-af

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Habitat type: Primary	Habitat type: Secondary	Woodland ordination symbol	Michigan soil management group
115E	VIIe	---	ATD	AVO	3R	
Trimountain						3a-af
Paavola						Ga/3-af
116B	VIs	---	ATD	AVO	3W	
Trimountain						3a-af
Paavola						Ga/3-af
Michigamme						3/Ra
116D	VIs	---	ATD	AVO	3R	
Trimountain						3a-af
Paavola						Ga/3-af
Michigamme						3/Ra
116E	VIIs	---	ATD	AVO	3R	
Trimountain						3a-af
Paavola						Ga/3-af
Michigamme						3/Ra
119A	VIIw	---	TMC	FI	3X	
Net						3b-af
Witbeck						3c
125	VIIw	---	PCS	TMC-Vac	2W	
Kinross						5c-a
Dawson						M/4c-a
127B	IIIe	---	ATD-D	TM		
Keweenaw					3A	4a-a
Kalkaska					3S	5a
127D	VIe	---	ATD-D	TM	3R	
Keweenaw						4a-a
Kalkaska						5a
127E	VIIe	---	ATD-D	TM	3R	
Keweenaw						4a-a
Kalkaska						5a
130B	IIIe	---	ATD	AVO		
Munising					3W	3a-af
Alcona					3L	3a-s
Liminga					3S	4a
130D	VIe	---	ATD	AVO	3R	
Munising						3a-af
Alcona						3a-s
Liminga						4a
130F	VIIe	---	ATD	AVO	3R	
Munising						3a-af
Alcona						3a-s
Liminga						4a
131B	IIe	---	ATD	TMC	3W	
Graveraet						2.5a-af
Misery						3b-af
132B	IVs	---	ATD-D	TM		
Kalkaska					3S	5a
Alcona					3L	3a-s

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Habitat type: Primary	Habitat type: Secondary	Woodland ordination symbol	Michigan soil management group
132D	VIIs	---	ATD-D	TM	3R	
Kalkaska						5a
Alcona						3a-s
132F	VIIs	---	ATD-D	TM	3R	
Kalkaska						5a
Alcona						3a-s
133B	IIIs	---	ATD-D	TM		
Liminga					3S	4a
Alcona					3L	3a-s
133D	IIIe	---	ATD-D	TM		
Liminga					3S	4a
Alcona					3L	3a-s
133E	VIe	---	ATD-D	TM	3R	
Liminga						4a
Alcona						3a-s
134A	IIIs	---	ATD-D	TMC		
Halfaday					3S	5a
Au Gres					6W	5b
135D	VIIs	---	QAE	PCS		
Deer Park					4S	5.3a
Roscommon					2W	5c
136B	VIs	---	ATD	TMC		
Michigamme					3W	3/Ra
Net					3X	3b-af
137A	IIIw	---	AVO-CI	FMC		
Sturgeon					3W	L-2b
Arnheim					5W	L-2c
Pelkie					3A	L-4a
138	Vw	---	FI	TTS	6W	Oc
Bergland						
139B	VIs	---	ATD	AVO		
Trimountain					3W	3a-af
Paavola					3W	Ga/3-af
Waiska					3S	Ga
139D	VIs	---	ATD	AVO		
Trimountain					3W	3a-af
Paavola					3W	Ga/3-af
Waiska					3S	Ga
139E	VIIs	---	ATD	AVO	3R	
Trimountain						3a-af
Paavola						Ga/3-af
Waiska						Ga
140B	IVe	---	ATD	AVO		
Trimountain					3W	3a-af
Paavola					3W	Ga/3-af
Waiska					3S	Ga

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Habitat type: Primary	Habitat type: Secondary	Woodland ordination symbol	Michigan soil management group
140D------------------	VIe	---	ATD	AVO	3R	
Trimountain----------						3a-af
Paavola--------------						Ga/3-af
Waiska---------------						Ga
140E------------------	VIIe	---	ATD	AVO	3R	
Trimountain----------						3a-af
Paavola--------------						Ga/3-af
Waiska---------------						Ga
142F------------------	VIIe	---	ATD-D	TM	3R	
Keweenaw-------------						4a-a
Kalkaska-------------						5a
Waiska---------------						Ga
144F------------------	VIIe	---	ATD	AVO	3R	
Graveraet------------						2.5a-af
Kalkaska-------------						5a
145B------------------	IVs	---	ATD-D	TM	3S	5a
Kalkaska-------------						
Halfaday-------------						
146-------------------	VIw	---	TTS	FI		
Cathro---------------					5W	M/3c
Gay------------------					7W	3c
147B------------------	IIe	---	ATD	---		
Munising-------------					3W	3a-af
Liminga--------------					3S	4a
Alcona---------------					3L	3a-s
148B------------------	IIIe	---	ATD	AVO		
Graveraet------------					3W	2.5a-af
Ocqueoc--------------					3S	4/2a
Kalkaska-------------					3S	5a
148D------------------	VIe	---	ATD	AVO	3R	
Graveraet------------						2.5a-af
Ocqueoc--------------						4/2a
Kalkaska-------------						5a
150B------------------	IIw	---	TMC-D	ATD		
Richter--------------					3W	2.5b
Alcona---------------					3L	3a-s
151B------------------	VIs	---	ATD	---	3X	3a-af
Champion						
152B------------------	VIs	---	ATD	---	3W	3/2a-f
Kallio						
153B------------------	VIs	---	ATD	---		
Champion-------------					3X	3a-af
Karlin---------------					3A	4a
Fence----------------					3L	3a
153D------------------	VIs	---	ATD	---		
Champion-------------					3X	3a-af
Karlin---------------					3A	4a
Fence----------------					3L	3a

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Habitat type		Woodland ordination symbol	Michigan soil management group
			Primary	Secondary		
153E	VIIs	---	ATD	---	3R	
Champion						3a-af
Karlin						4a
Fence						3a
154B	IVs	---	AQVac	TMV		
Vilas					6A	4a
Rubicon					4S	5.3a
154E	VIIs	---	AQVac	TMV		
Vilas					6R	4a
Rubicon					4R	5.3a

* Where drained.

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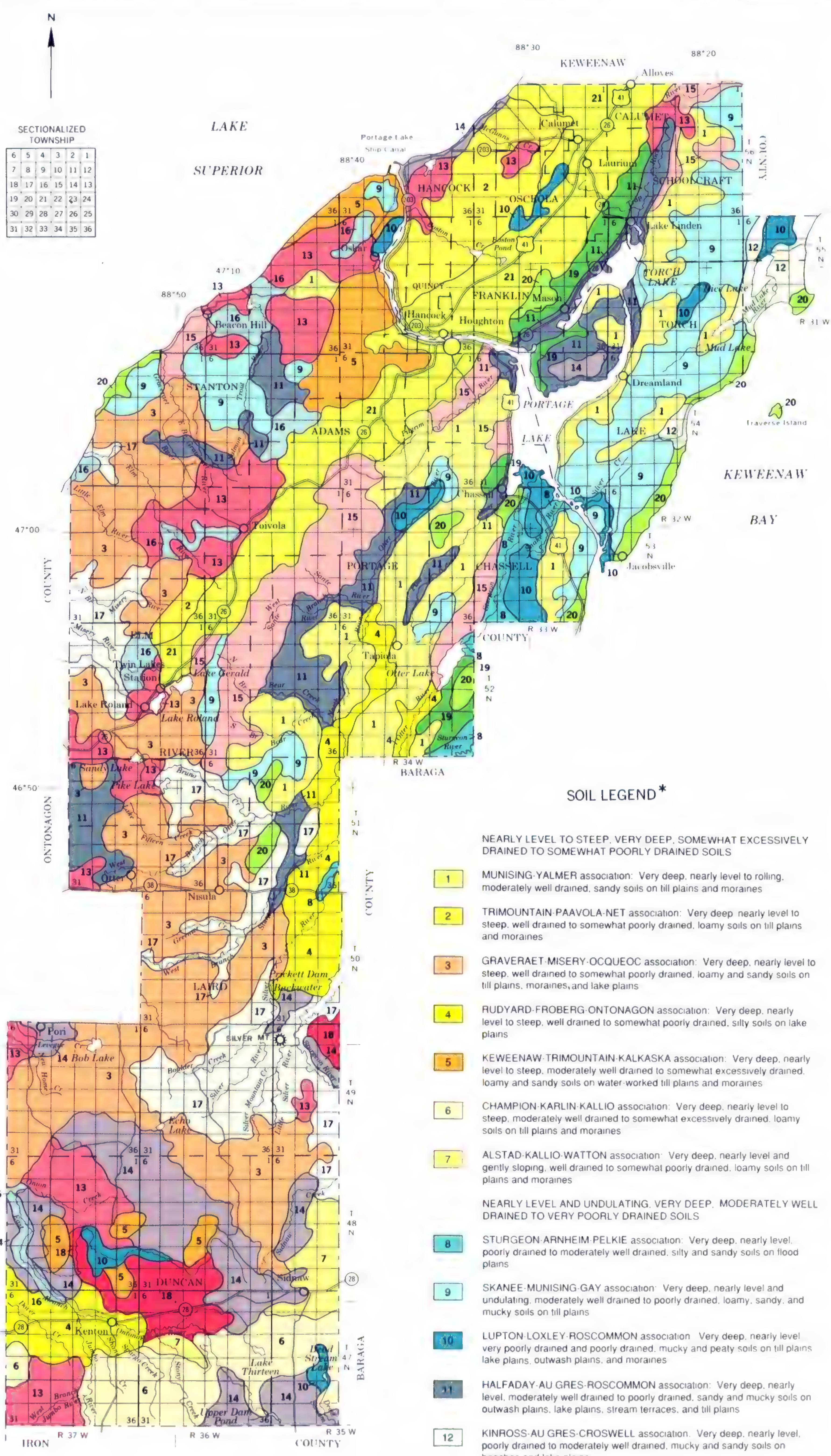


SOIL LEGEND*

NEARLY LEVEL TO STEEP, VERY DEEP, SOMEWHAT EXCESSIVELY DRAINED TO SOMEWHAT POORLY DRAINED SOILS

1 MUNISING-YALMER association: Very deep, nearly level to rolling, moderately well drained, sandy soils on till plains and moraines

2 TRIMOUNTAIN-PAAVOLA-NET association: Very deep, nearly level to steep, well drained to somewhat poorly drained, loamy soils on till plains and moraines

3 GRAVERAET-MISERY-OCQUEOC association: Very deep, nearly level to steep, well drained to somewhat poorly drained, loamy and sandy soils on till plains, moraines, and lake plains

4 RUDYARD-FROBERG-ONTONAGON association: Very deep, nearly level to steep, well drained to somewhat poorly drained, silty soils on lake plains

5 KEWEENAW-TRIMOUNTAIN-KALKASKA association: Very deep, nearly level to steep, moderately well drained to somewhat excessively drained, loamy and sandy soils on water-worked till plains

6 CHAMPION-KARLIN-KALLIO association: Very deep, nearly level to steep, moderately well drained to somewhat excessively drained, loamy soils on till plains and moraines

7 ALSTAD-KALLIO-WATTON association: Very deep, nearly level and gently sloping, well drained to somewhat poorly drained, loamy soils on till plains and moraines

NEARLY LEVEL AND UNDULATING, VERY DEEP, MODERATELY WELL DRAINED TO VERY POORLY DRAINED SOILS

8 STURGEON-ARNHEIM-PELKIE association: Very deep, nearly level, poorly drained to moderately well drained, silty and sandy soils on flood plains

9 SKANEE-MUNISING-GAY association: Very deep, nearly level and undulating, moderately well drained to poorly drained, loamy, sandy, and mucky soils on till plains

10 LUPTON-LOXLEY-ROSCOMMON association: Very deep, nearly level very poorly drained and poorly drained, mucky and peaty soils on till plains lake plains, outwash plains, and moraines

11 HALFADAY-AU GRES-ROSCOMMON association: Very deep, nearly level, moderately well drained to poorly drained, sandy and mucky soils on outwash plains, lake plains, stream terraces, and till plains

12 KINROSS-AU GRES-CROSWELL association: Very deep, nearly level, poorly drained to moderately well drained, mucky and sandy soils on beaches and lake plains

NEARLY LEVEL TO VERY STEEP, VERY DEEP, WELL DRAINED TO EXCESSIVELY DRAINED SOILS

13 KALKASKA-LIMINGA-WAISKA association: Very deep, nearly level to steep, well drained to excessively drained, sandy soils on outwash plains

14 VILAS-RUBICON association: Very deep, nearly level to steep excessively drained, sandy soils on outwash plains, lake plains, and moraines

15 MUNISING-YALMER-LIMINGA association: Very deep, nearly level to very steep, well drained, sandy soils on dissected till plains and moraines

16 KALKASKA-WAISKA association: Very deep, moderately sloping to very steep, somewhat excessively drained and excessively drained, sandy soils on dissected outwash plains

17 GRAVERAET-KALKASKA association: Very deep, moderately steep to very steep, well drained and somewhat excessively drained, loamy and sandy soils on dissected, water-worked till plains and moraines

18 NUNICA-FENCE-ALCONA association: Very deep, nearly level to very steep, well drained and moderately well drained, silty, loamy, and sandy soils on dissected lake plains

NEARLY LEVEL TO VERY STEEP, VERY DEEP, MODERATELY DEEP, AND SHALLOW SOMEWHAT EXCESSIVELY DRAINED TO SOMEWHAT POORLY DRAINED SOILS

19 MUNISING-ABBAYE-KALKASKA association: Very deep and moderately deep, nearly level to very steep, well drained and somewhat excessively drained, sandy soils on dissected till plains and moraines

20 ABBAYE-ZEBA-MUNISING association: Very deep and moderately deep, nearly level and gently sloping, moderately well drained and somewhat poorly drained, sandy and loamy soils on sandstone benches and till plains

21 TRIMOUNTAIN-PAAVOLA-ARCADIAN association: Very deep and shallow, nearly level to very steep, well drained and moderately well drained, loamy soils on till plains and moraines

* Texture terms in the descriptive headings refer to the surface layer of the major soils in the associations.

Compiled 1991

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN AGRICULTURAL EXPERIMENT STATION
MICHIGAN TECHNOLOGICAL UNIVERSITY

GENERAL SOIL MAP

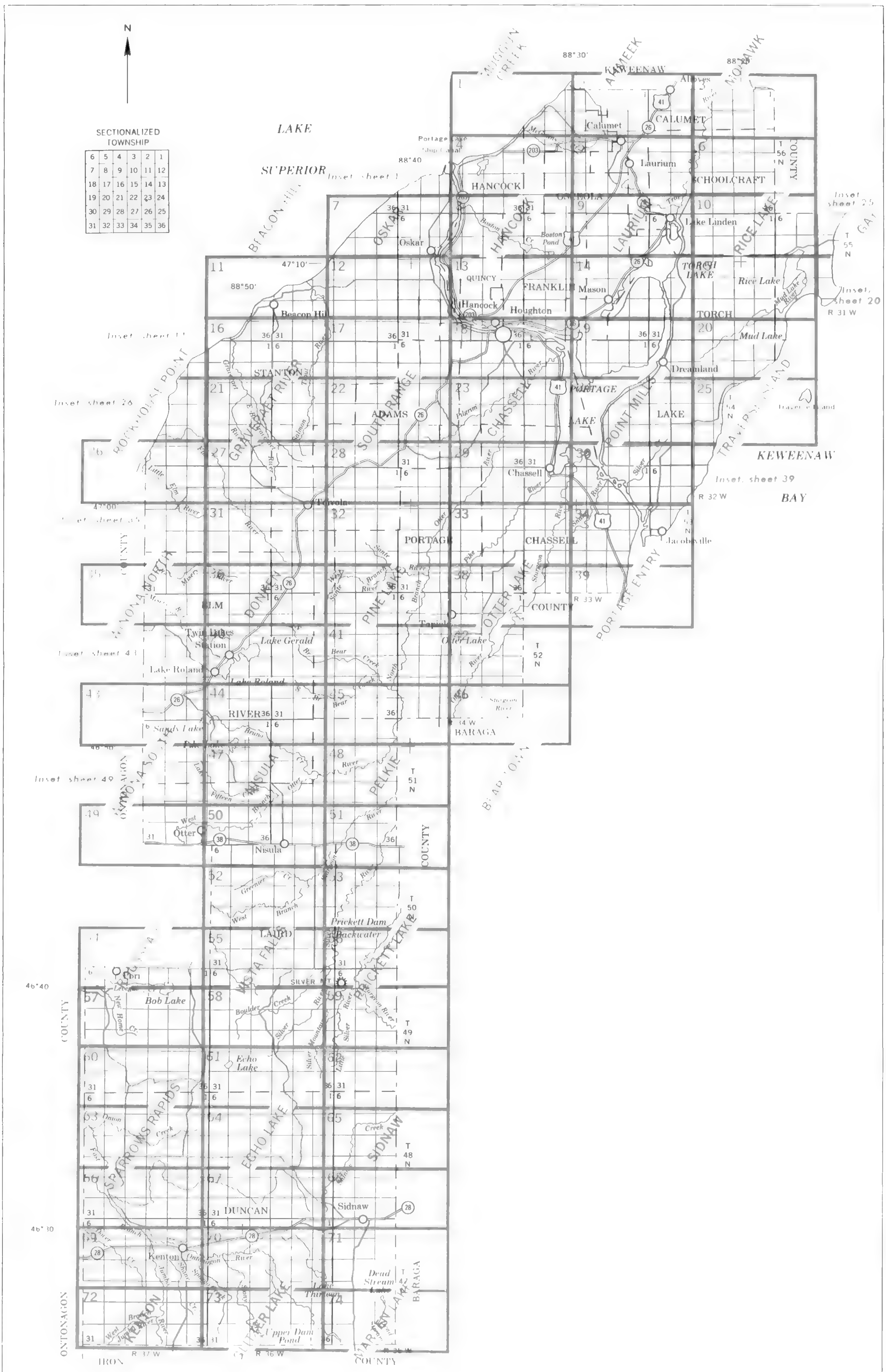
HOUGHTON COUNTY AREA, MICHIGAN

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km



Original text from each individual map sheet read:
This soil survey map is compiled on 1975 and 1978 orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and U.S. Geological Survey. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS
HOUGHTON COUNTY AREA, MICHIGAN

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME	SYMBOL	NAME
10B	Munising loamy fine sand, 1 to 8 percent slopes	89D	Trimountain-Paavola complex, 8 to 15 percent slopes
10D	Munising loamy fine sand, 8 to 15 percent slopes	89E	Trimountain-Paavola complex, 15 to 35 percent slopes
10E	Munising loamy fine sand, 15 to 35 percent slopes	90	Witbeck very stony muck
11A	Skanee fine sandy loam, 0 to 3 percent slopes	92B	Arcadian-Michigamme-Rock outcrop complex, 1 to 8 percent slopes
12	Gay muck	92D	Arcadian-Michigamme-Rock outcrop complex, 8 to 15 percent slopes
14A	Assinins sand, 0 to 3 percent slopes	92E	Arcadian-Michigamme-Rock outcrop complex, 15 to 35 percent slopes
15B	Kalkaska sand, 0 to 8 percent slopes	95A	Assinins-Skanee complex, 0 to 3 percent slopes
15D	Kalkaska sand, 8 to 15 percent slopes	96B	Liminga fine sand, 0 to 8 percent slopes
15E	Kalkaska sand, 15 to 35 percent slopes	96D	Liminga fine sand, 8 to 15 percent slopes
16B	Rubicon sand, 0 to 8 percent slopes	96E	Liminga fine sand, 15 to 35 percent slopes
16D	Rubicon sand, 8 to 15 percent slopes	96F	Liminga fine sand, 35 to 70 percent slopes
17A	Croswell sand, 0 to 3 percent slopes	98B	Munising-Yalmer complex, dissected, 1 to 12 percent slopes
18A	Au Gres sand, 0 to 3 percent slopes	98D	Munising-Yalmer complex, dissected, 8 to 35 percent slopes
21B	Keweenaw-Kalkaska complex, 1 to 8 percent slopes	98E	Munising-Yalmer complex, dissected, 15 to 60 percent slopes
21D	Keweenaw-Kalkaska complex, 8 to 15 percent slopes	100A	Au Gres-Roscommon complex, 0 to 3 percent slopes
22B	Abbaye-Munising loamy fine sands, 1 to 8 percent slopes	101A	Net stony fine sandy loam, 0 to 3 percent slopes
23A	Zeba-Jacobsville complex, 0 to 3 percent slopes	102A	Net-Witbeck complex, 0 to 3 percent slopes
24B	Deerton sand, 1 to 8 percent slopes	103B	Trimountain-Net complex, 0 to 8 percent slopes
25	Lupton and Cathro mucks	104D	Urban land-Udorthents complex, strongly sloping, rocky
26	Dawson and Loxley peats	106B	Urban land-Udorthents-Udipsamments complex, gently sloping
27	Histosols and Aquents, ponded	106D	Urban land-Udorthents-Udipsamments complex, strongly sloping
29B	Waiska sand, 0 to 8 percent slopes	106E	Urban land-Udorthents-Udipsamments complex, steep
30B	Munising-Skanee complex, 0 to 8 percent slopes	107B	Kalkaska-Waiska sands, 0 to 8 percent slopes
31A	Skanee-Gay complex, 0 to 3 percent slopes	107D	Kalkaska-Waiska sands, 8 to 15 percent slopes
32B	Alcona loamy fine sand, 1 to 8 percent slopes	107E	Kalkaska-Waiska sands, 15 to 35 percent slopes
33B	Munising-Yalmer complex, 1 to 8 percent slopes	108B	Freda silt loam, 1 to 8 percent slopes
33D	Munising-Yalmer complex, 8 to 15 percent slopes	110D	Kalkaska-Waiska sands, dissected, 8 to 35 percent slopes
34B	Munising loamy fine sand, dissected, 1 to 12 percent slopes	110E	Kalkaska-Waiska sands, dissected, 15 to 60 percent slopes
34D	Munising loamy fine sand, dissected, 8 to 35 percent slopes	115B	Trimountain-Paavola complex, dissected, 1 to 12 percent slopes
34E	Munising loamy fine sand, dissected, 15 to 60 percent slopes	115D	Trimountain-Paavola complex, dissected, 8 to 35 percent slopes
35B	Graveraet loam, 1 to 8 percent slopes	115E	Trimountain-Paavola complex, dissected, 15 to 60 percent slopes
35D	Graveraet loam, 8 to 15 percent slopes	116B	Trimountain-Paavola-Michigamme complex, dissected, 1 to 12 percent slopes, rocky
35E	Greveraet loam, 15 to 35 percent slopes	116D	Trimountain-Paavola-Michigamme complex, dissected, 8 to 35 percent slopes, rocky
36A	Sturgeon silt loam	116E	Trimountain-Paavola-Michigamme complex, dissected, 15 to 60 percent slopes, rocky
37	Arnheim silt loam	119A	Net-Witbeck complex, 0 to 3 percent slopes, rocky
38A	Pelkie loamy fine sand, 0 to 3 percent slopes	125	Kinross-Dawson complex
41A	Misery very fine sandy loam, 0 to 3 percent slopes	127B	Keweenaw-Kalkaska complex, dissected, 1 to 12 percent slopes
45	Pits, borrow	127D	Keweenaw-Kalkaska complex, dissected, 8 to 35 percent slopes
46B	Karlin-Kalkaska complex, 0 to 8 percent slopes	127E	Keweenaw-Kalkaska complex, dissected, 15 to 60 percent slopes
46D	Karlin-Kalkaska complex, 8 to 15 percent slopes	130B	Munising-Alcona-Liminga complex, dissected, 1 to 12 percent slopes
47B	Ocqueoc-Halfaday complex, 0 to 8 percent slopes	130D	Munising-Alcona-Liminga complex, dissected, 8 to 35 percent slopes
51A	Allendale-Rudyard complex, 0 to 3 percent slopes	130F	Munising-Alcona-Liminga complex, dissected, 15 to 70 percent slopes
52B	Allouez gravelly silt loam, 1 to 8 percent slopes	131B	Graveraet-Misery complex, 0 to 8 percent slopes
55	Dumps, mine	132B	Kalkaska-Alcona complex, dissected, 1 to 12 percent slopes
56	Jacobsville muck	132D	Kalkaska-Alcona complex, dissected, 8 to 35 percent slopes
58B	Manistee-Ontonagon complex, dissected, 1 to 12 percent slopes	132F	Kalkaska-Alcona complex, dissected, 15 to 70 percent slopes
59B	Graveraet-Ocqueoc-Kalkaska complex, 1 to 8 percent slopes	133B	Liminga-Alcona complex, 0 to 8 percent slopes
60B	Nunica-Fence complex, dissected, 1 to 12 percent slopes	133D	Liminga-Alcona complex, 8 to 15 percent slopes
60D	Nunica-Fence complex, dissected, 8 to 35 percent slopes	133E	Liminga-Alcona complex, 15 to 35 percent slopes
60E	Nunica-Fence complex, dissected, 15 to 60 percent slopes	134A	Halfaday-Au Gres sands, 0 to 3 percent slopes
61B	Ontonagon silt loam, 1 to 6 percent slopes	135D	Deer Park-Kinross complex, 0 to 15 percent slopes
61D	Ontonagon silt loam, 6 to 15 percent slopes	136B	Michigamme-Net complex, 0 to 8 percent slopes, rocky
61E	Ontonagon silt loam, 15 to 35 percent slopes	137A	Sturgeon-Arnheim-Pelkie complex
65A	Rudyard silt loam, 0 to 3 percent slopes	138	Bergland muck
66B	Munising-Abbaye-Kalkaska complex, dissected, 1 to 12 percent slopes, rocky	139B	Trimountain-Paavola-Waiska complex, 1 to 8 percent slopes
66D	Munising-Abbaye-Kalkaska complex, dissected, 8 to 35 percent slopes, rocky	139D	Trimountain-Paavola-Waiska complex, 8 to 15 percent slopes
66F	Munising-Abbaye-Kalkaska complex, dissected, 15 to 70 percent slopes, rocky	139E	Trimountain-Paavola-Waiska complex, 15 to 35 percent slopes
67	Roscommon muck	140B	Trimountain-Paavola-Waiska complex, dissected, 1 to 12 percent slopes
68	Dumps, stamp sand	140D	Trimountain-Paavola-Waiska complex, dissected, 8 to 35 percent slopes
69B	Watton-Alstad loams, 0 to 8 percent slopes	140E	Trimountain-Paavola-Waiska complex, dissected, 15 to 60 percent slopes
70B	Watton loam, 1 to 8 percent slopes	142F	Keweenaw-Kalkaska-Waiska complex, dissected, 15 to 70 percent slopes
71A	Richter very fine sandy loam, 0 to 3 percent slopes	144F	Graveraet-Kalkaska complex, dissected, 15 to 70 percent slopes
72A	Halfaday sand, 0 to 3 percent slopes	145B	Kalkaska-Halfaday sands, 0 to 8 percent slopes
73B	Froberg-Rudyard silt loams, 1 to 8 percent slopes	146	Cathro-Gay mucks
75A	Croswell-Au Gres sands, 0 to 3 percent slopes	147B	Munising-Liminga-Alcona complex, 1 to 8 percent slopes
76A	Au Gres-Kinross complex, 0 to 3 percent slopes	148B	Graveraet-Ocqueoc-Kalkaska complex, dissected, 1 to 12 percent slopes
77	Tawas-Roscommon mucks	148D	Graveraet-Ocqueoc-Kalkaska complex, dissected, 8 to 35 percent slopes
78B	Deer Park sand, 0 to 8 percent slopes	150B	Richter-Alcona complex, 0 to 8 percent slopes
79B	Yalmer-Assinins sands, 0 to 8 percent slopes	151B	Champion cobbly very fine sandy loam, 1 to 8 percent slopes
83	Udipsamments and Udorthents, nearly level	152B	Kallio cobbly very fine sandy loam, 1 to 8 percent slopes
84B	Graveraet loam, dissected, 1 to 12 percent slopes	153B	Champion-Karlin-Fence complex, 1 to 8 percent slopes
84D	Greveraet loam, dissected, 8 to 35 percent slopes	153D	Champion-Karlin-Fence complex, 8 to 15 percent slopes
84E	Graveraet loam, dissected, 15 to 60 percent slopes	153E	Champion-Karlin-Fence complex, 15 to 35 percent slopes
86B	Trimountain cobbly fine sandy loam, 1 to 8 percent slopes	154B	Vilas-Rubicon complex, 0 to 6 percent slopes
86D	Trimountain cobbly fine sandy loam, 8 to 15 percent slopes	154E	Vilas-Rubicon complex, 10 to 35 percent slopes
86E	Trimountain cobbly fine sandy loam, 15 to 35 percent slopes		
89B	Trimountain-Paavola complex, 1 to 8 percent slopes		

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label) — Smith Airport

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small — water

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 68 154E

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

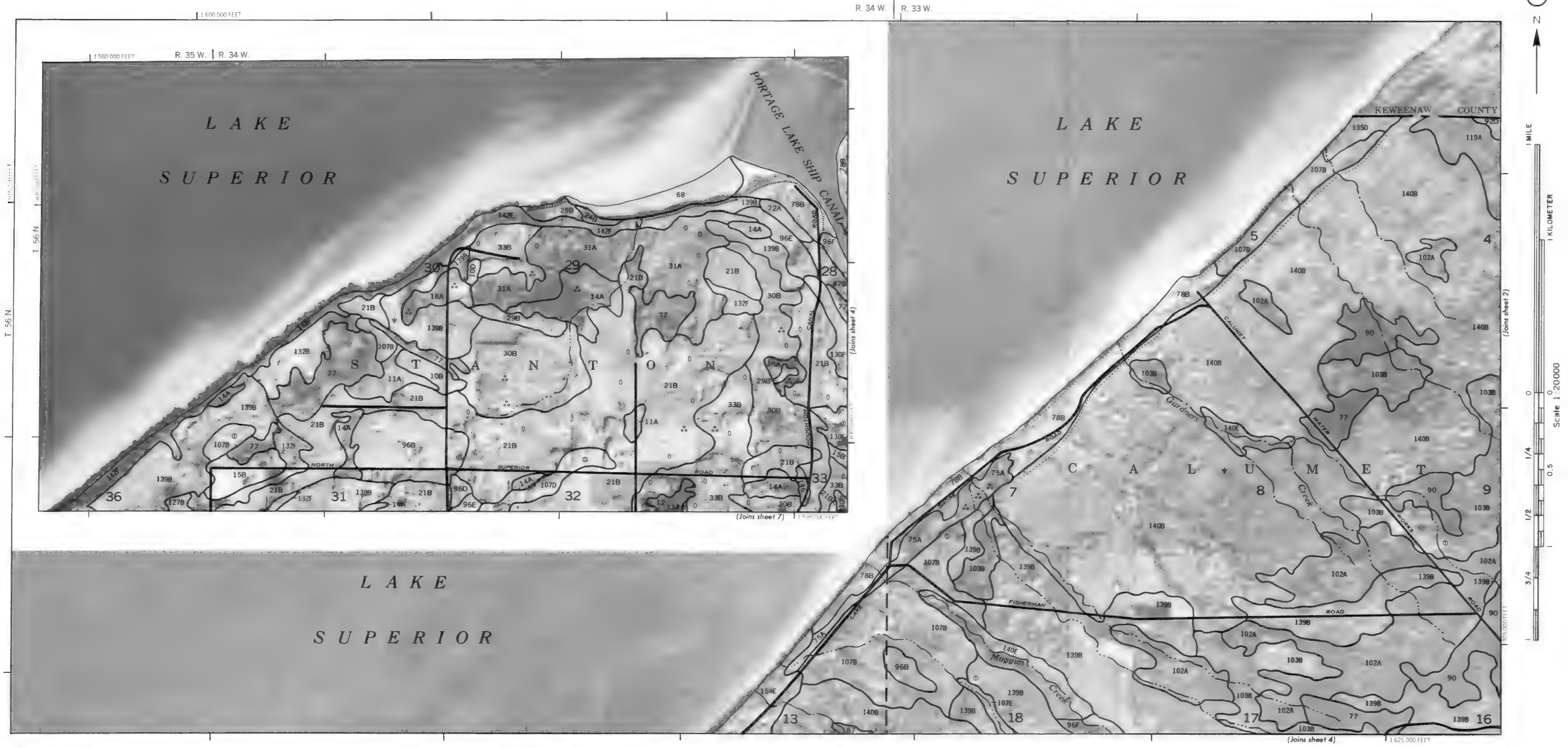
SOIL SAMPLE (normally not shown) — S

MISCELLANEOUS

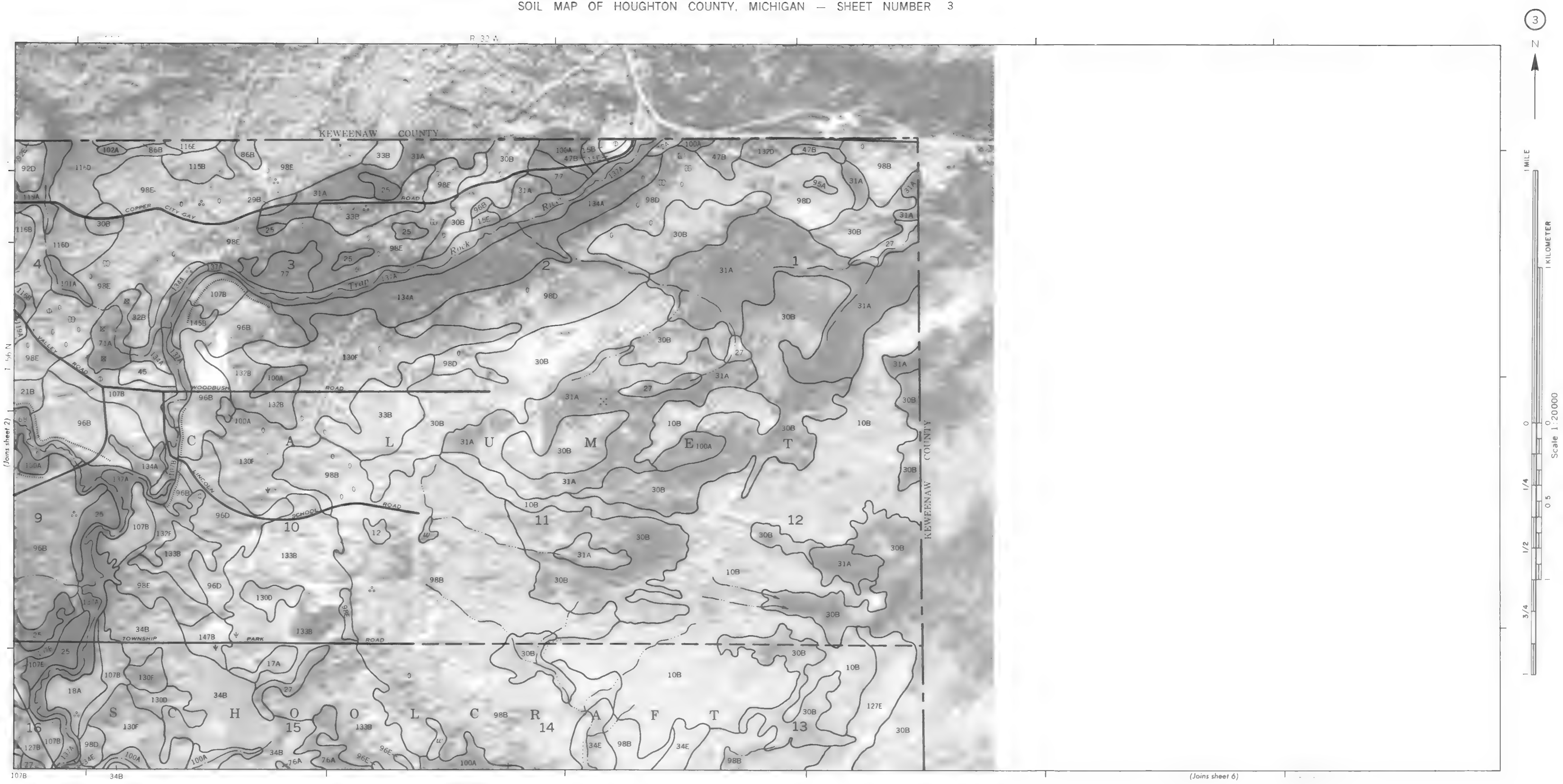
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Well drained area * (Up to 5 ac.)
- Muck spot
- Borrow pit
- Filled area
- Mine dump
- Sanitary landfill
- Loamy spot
- <40" to rock
- Mine shaft

* in poorly drained unit

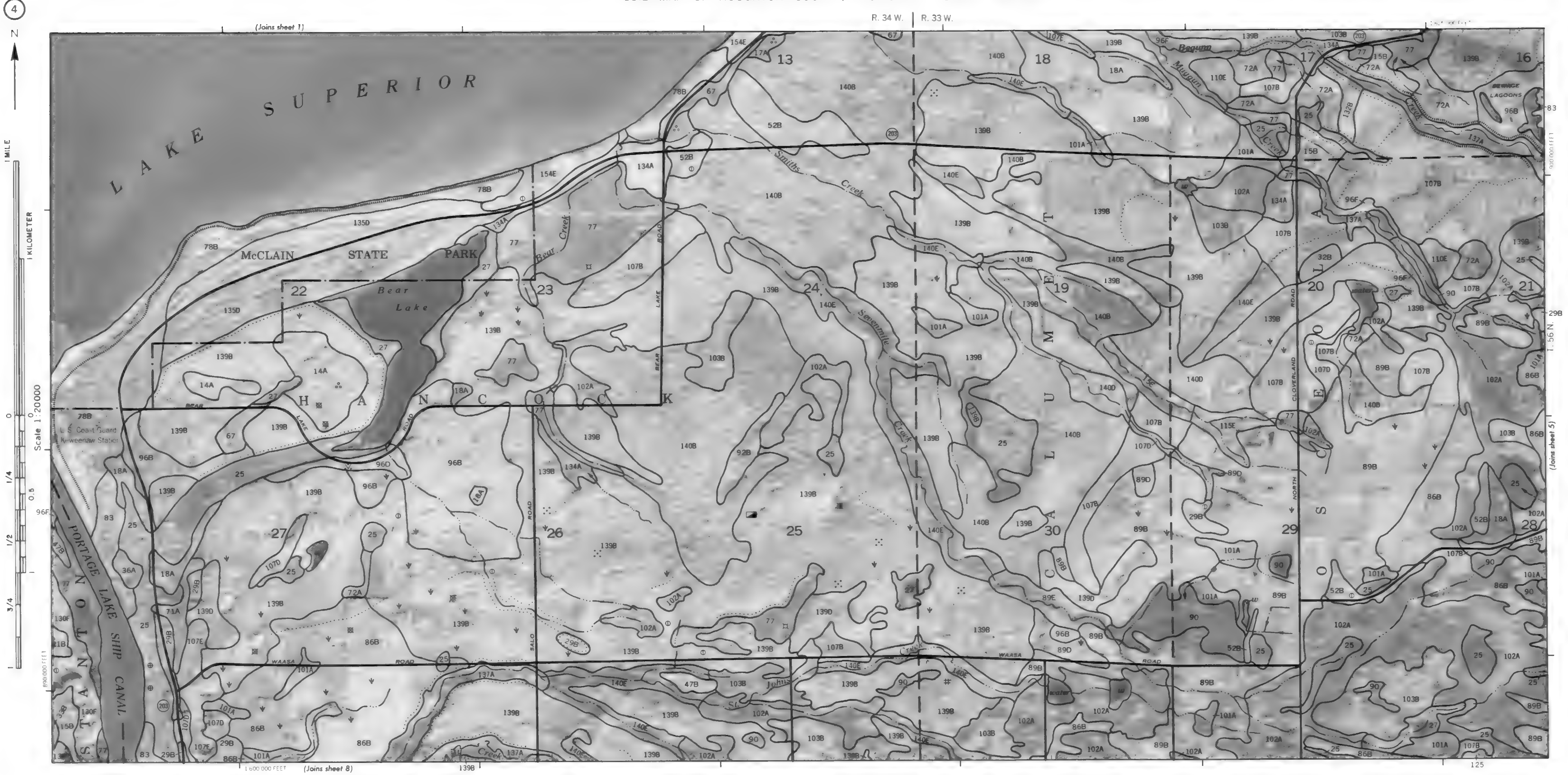
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 1



SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 2

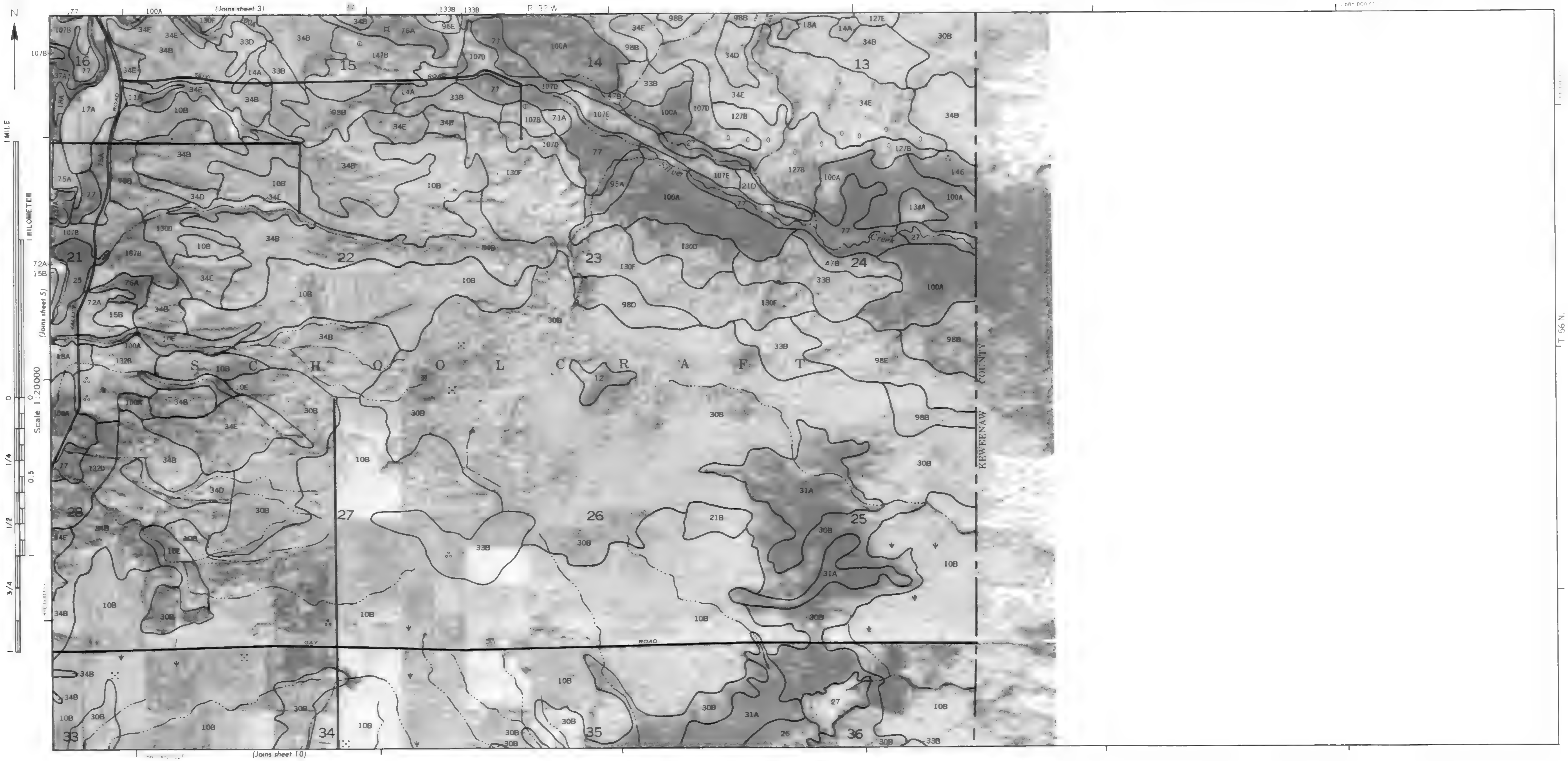

3
N
KEWEENAW COUNTY
COPPER CITY GAY ROAD
Trap Rock River
VALLEY ROAD
WOODBUSH ROAD
LINCOLN SCHOOL ROAD
TOWNSHIP PARK ROAD
C A L U M E T
S C H O O L C R A F T
KEWEENAW COUNTY
(Joins sheet 2)
(Joins sheet 6)
1 MILE
1 KILOMETER
Scale 1:20000

SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 4

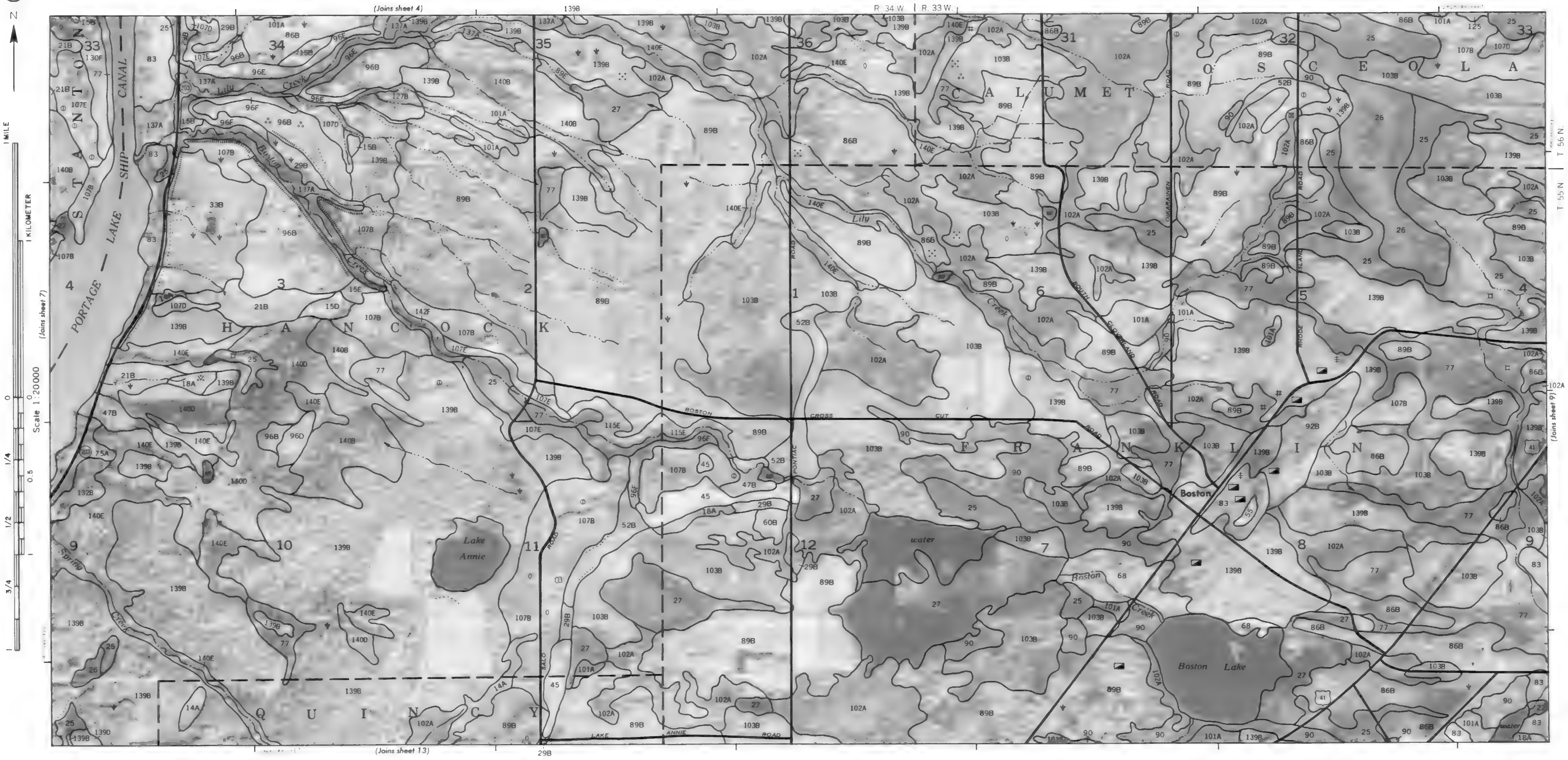


SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 5

6

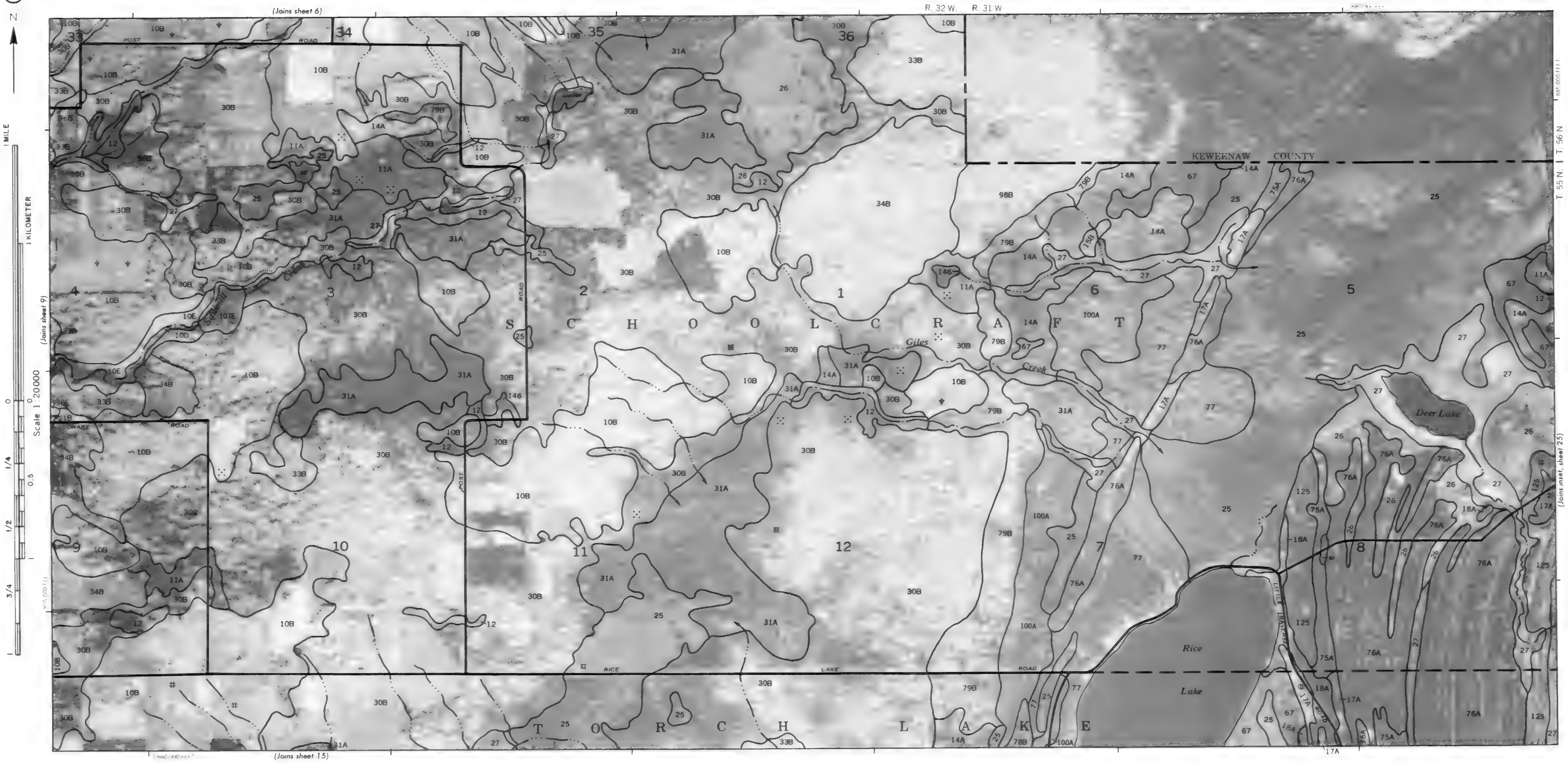

(Joins sheet 3)
R. 32 W.
(Joins sheet 5)
(Joins sheet 10)
T. 56 N.
S C H O O L C R A F T
KEWEENAW COUNTY
Silver
Creek
GAY
ROAD
Scale 1:20000
1 MILE
KILOMETER
N

SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 7

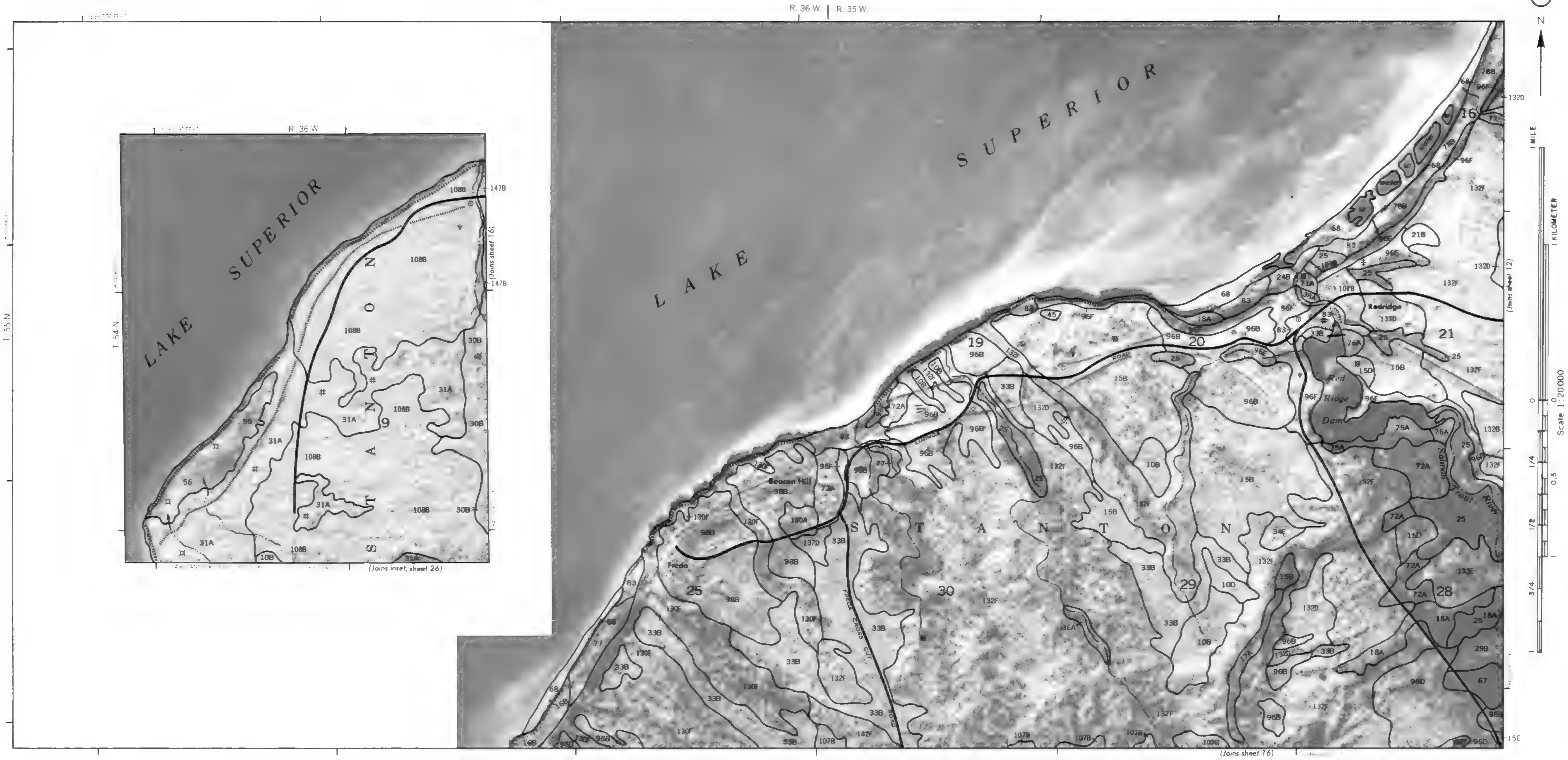

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 4)
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 13)
R. 34 W.
R. 33 W.
T. 56 N.
T. 55 N.
STANTON
HANCOCK
QUINCY
CALUMET
OSCEOLA
FRANKLIN
PORTAGE LAKE SHIP CANAL
Lily Creek
Boston Creek
Spring Creek
Lake Annie
Boston Lake
water
Boston
BOSTON CROSS CUT ROAD
LAKE ANNIE ROAD
PONTIAC ROAD
BALLO ROAD
SOUTH CLOVERLAND ROAD
OIKARAINEN ROAD
RHODE ISLAND ROAD

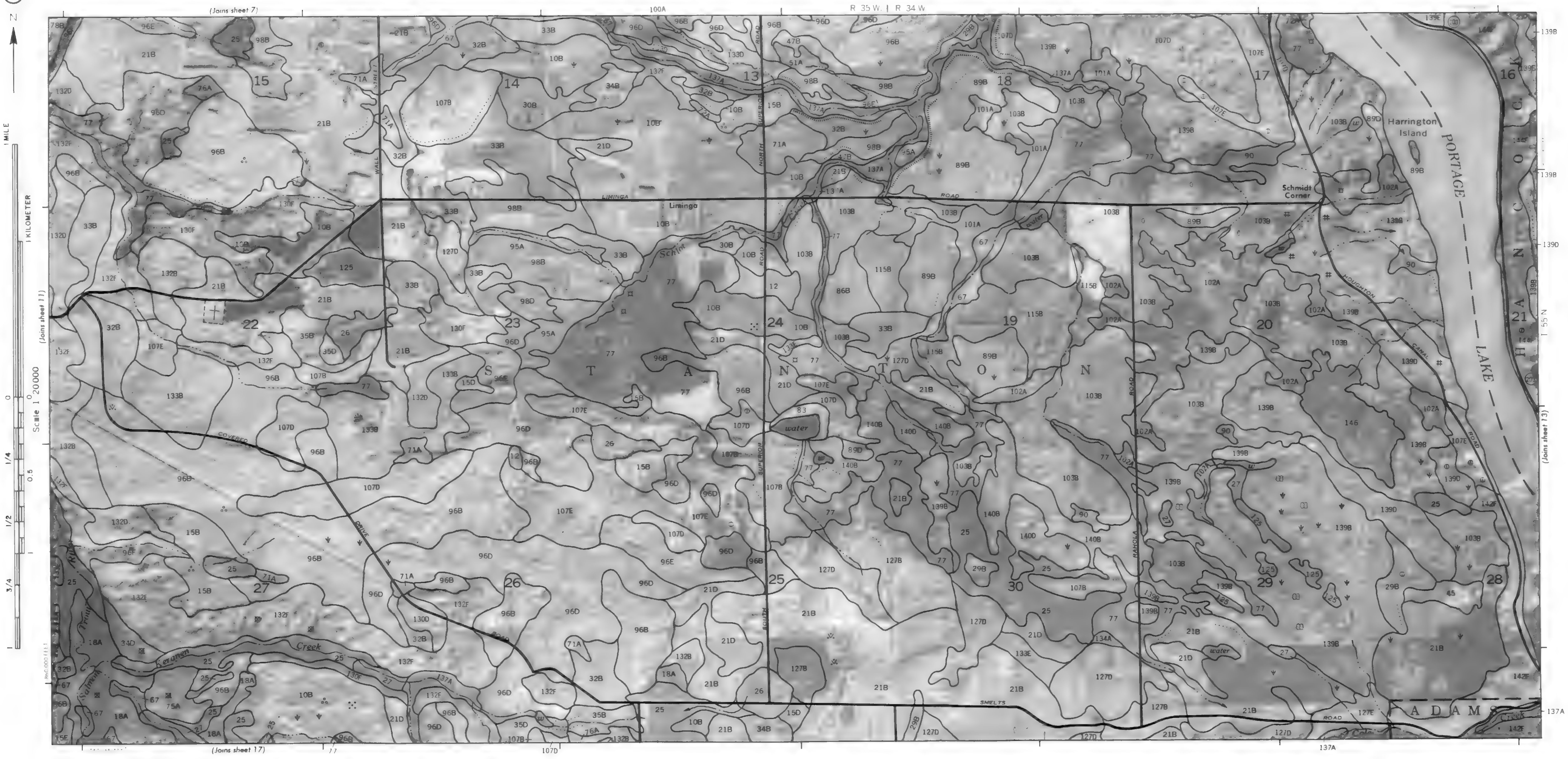

9
N
R. 33 W.
R. 32 W.
(Joins sheet 5)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 14)
T. 56 N.
T. 55 N.
C A L U M E T
S C H O O L C R A F T
T O R C H L A K E
T O R C H
L A K E
Houghton Falls
Hammell Creek
Lake Linden
water
Hubbell
Tamarack City
Hungarian Falls
Dover Creek
Sawmill
HOUGHTON
COUNTY
MEMORIAL
AIRPORT
1 MILE
1 KILOMETER
Scale 1:20000

(10)


(Joins sheet 6)
(Joins sheet 9)
(Joins sheet 15)
(Joins inset, sheet 25)
R. 32 W.
R. 31 W.
T. 56 N.
T. 55 N.
N
1 MILE
1 KILOMETER
Scale 1:20000
KEWEENAW COUNTY
S C H O O L C R A F T
T O R C H L A K E
Giles Creek
Deer Lake
Rice Lake
POST ROAD
RICE LAKE ROAD
DRAKE ROAD

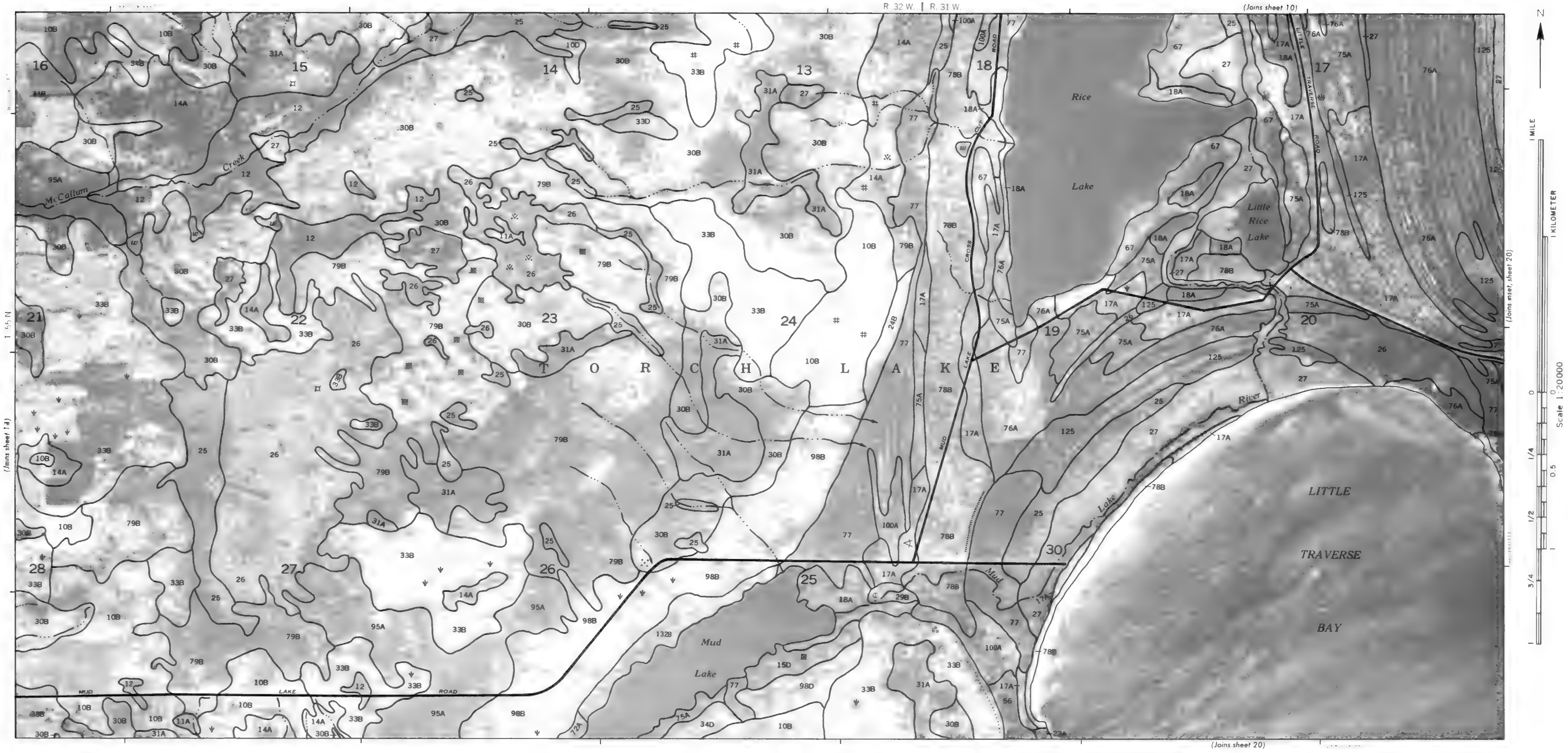
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 11




N
(Joins sheet 7)
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 17)
R 35 W. | R 34 W.
T 55 N.
1 MILE
1 KILOMETER
Scale 1:20000
Limingo
LIMINGA ROAD
NORTH SUPERIOR ROAD
SOUTH SUPERIOR ROAD
WALL STREET
COVERED DRIVE
RAHOLA ROAD
SMELTS ROAD
HOUGHTON CANAL ROAD
Schmidt Corner
Harrington Island
PORTAGE LAKE
HANCOCK
STANTON
ADAMS
Schlint Creek
Kevanen Creek
Salmon Trout River
water

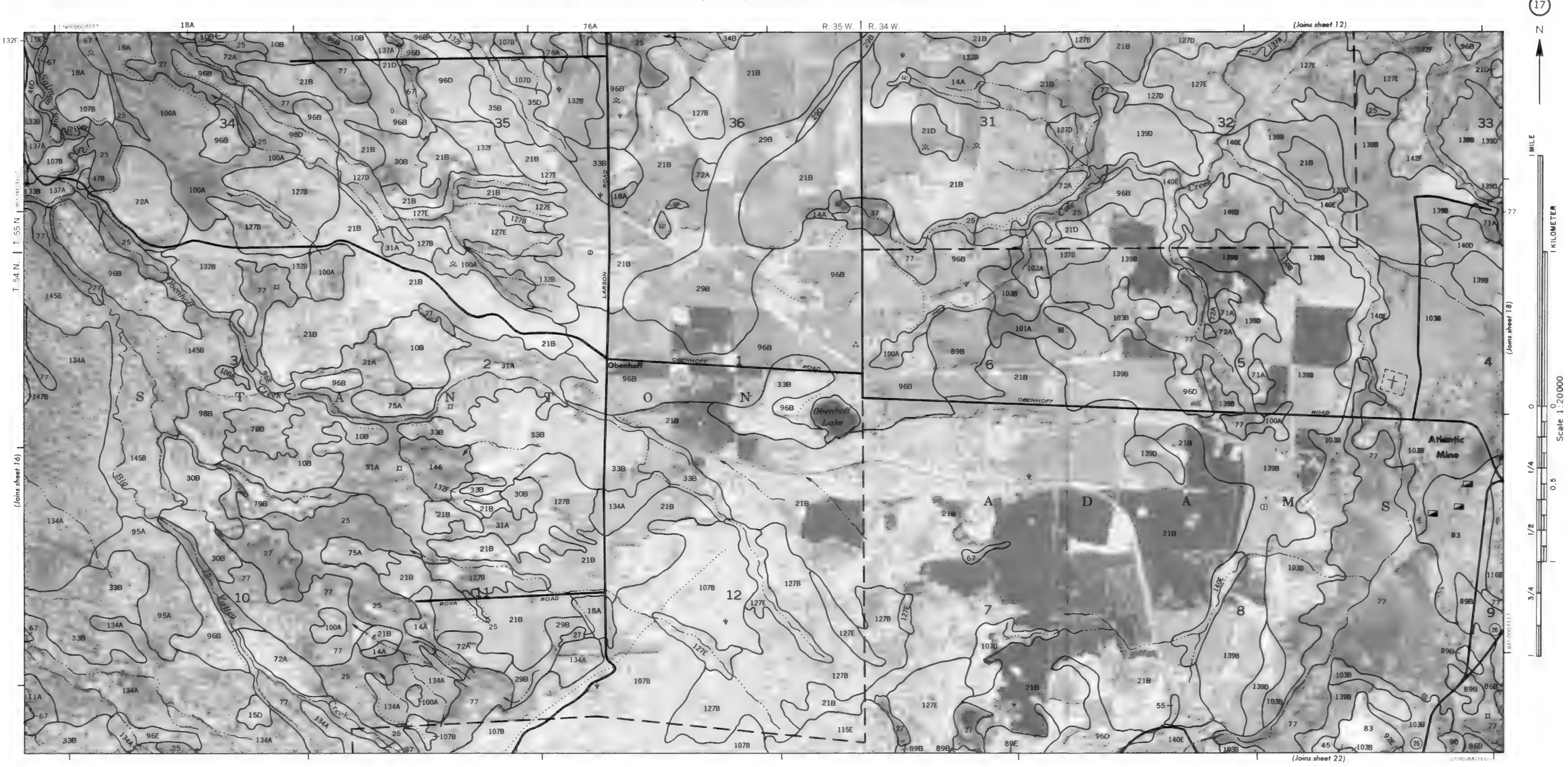
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 13

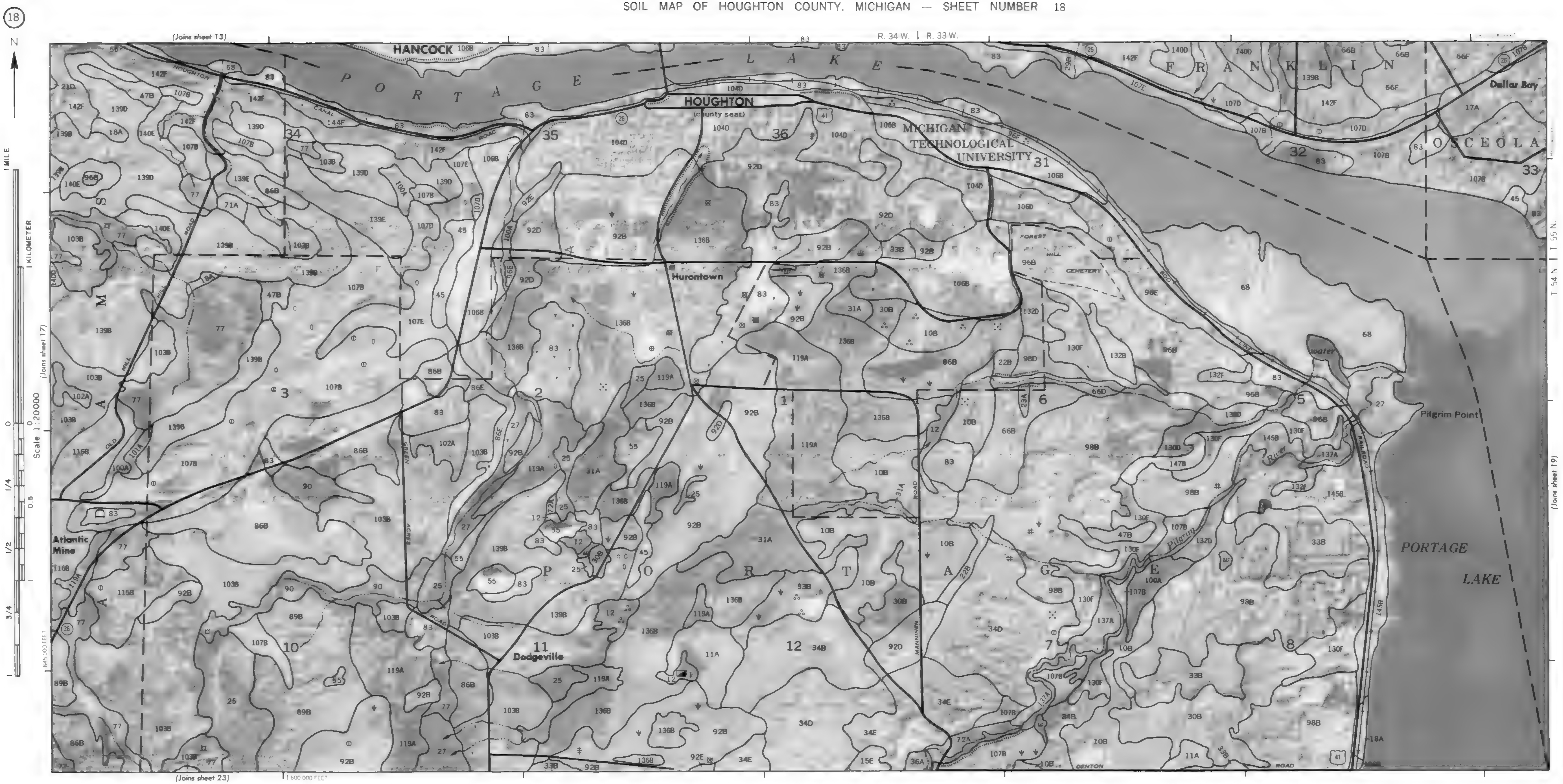
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 14

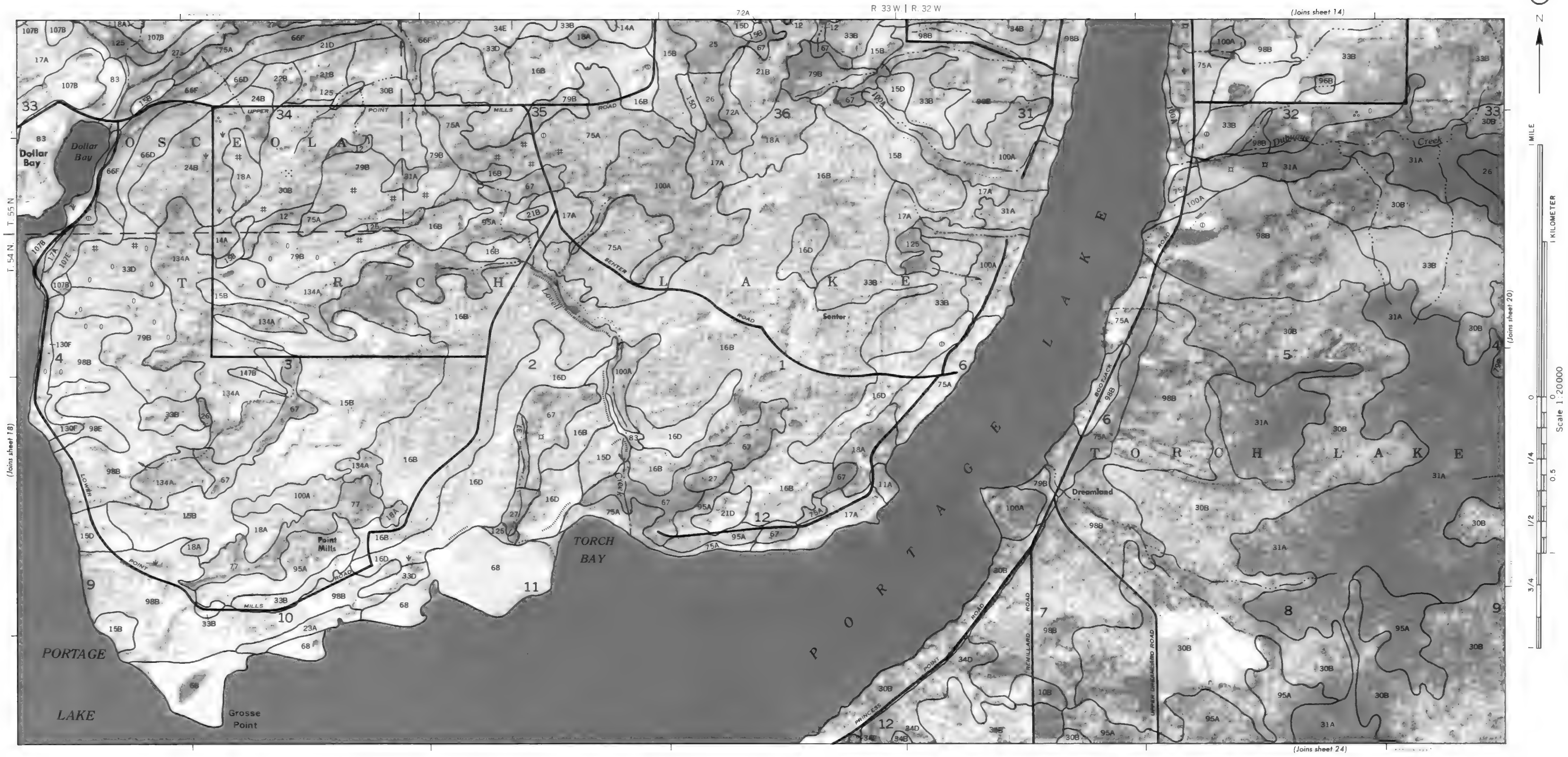

15
N
R. 32 W. | R. 31 W.
(Joins sheet 10)
(Joins sheet 14)
(Joins inset, sheet 20)
(Joins sheet 20)
T. 55 N.
TORCH LAKE
Rice Lake
Little Rice Lake
LITTLE TRAVERSE BAY
Mud Lake
McCallum Creek
Lake River
Mud Lake
MUD LAKE ROAD
CROSS CUT ROAD
LITTLE TRAVERSE ROAD
LAKE
MUD
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 16

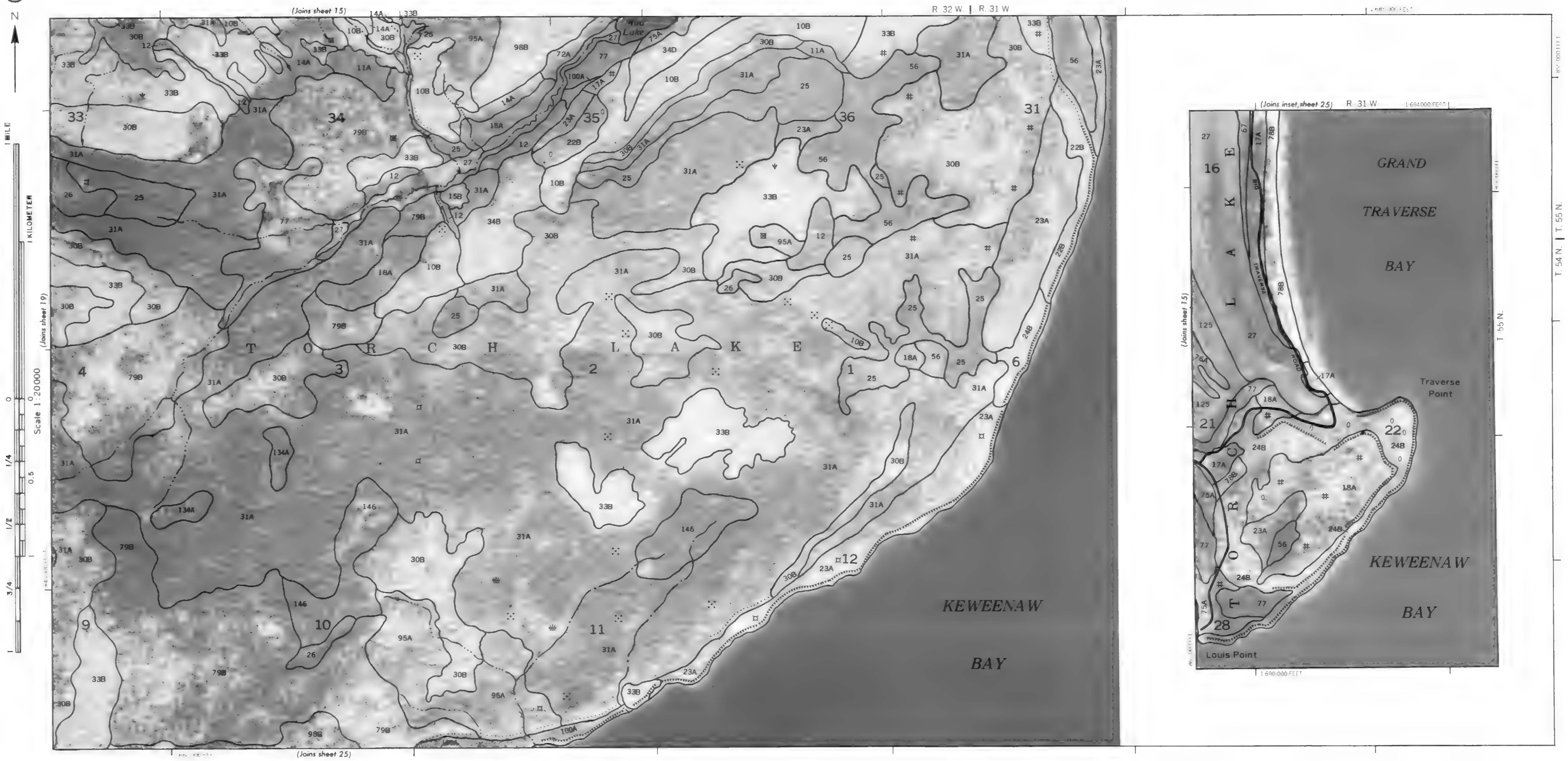
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 17

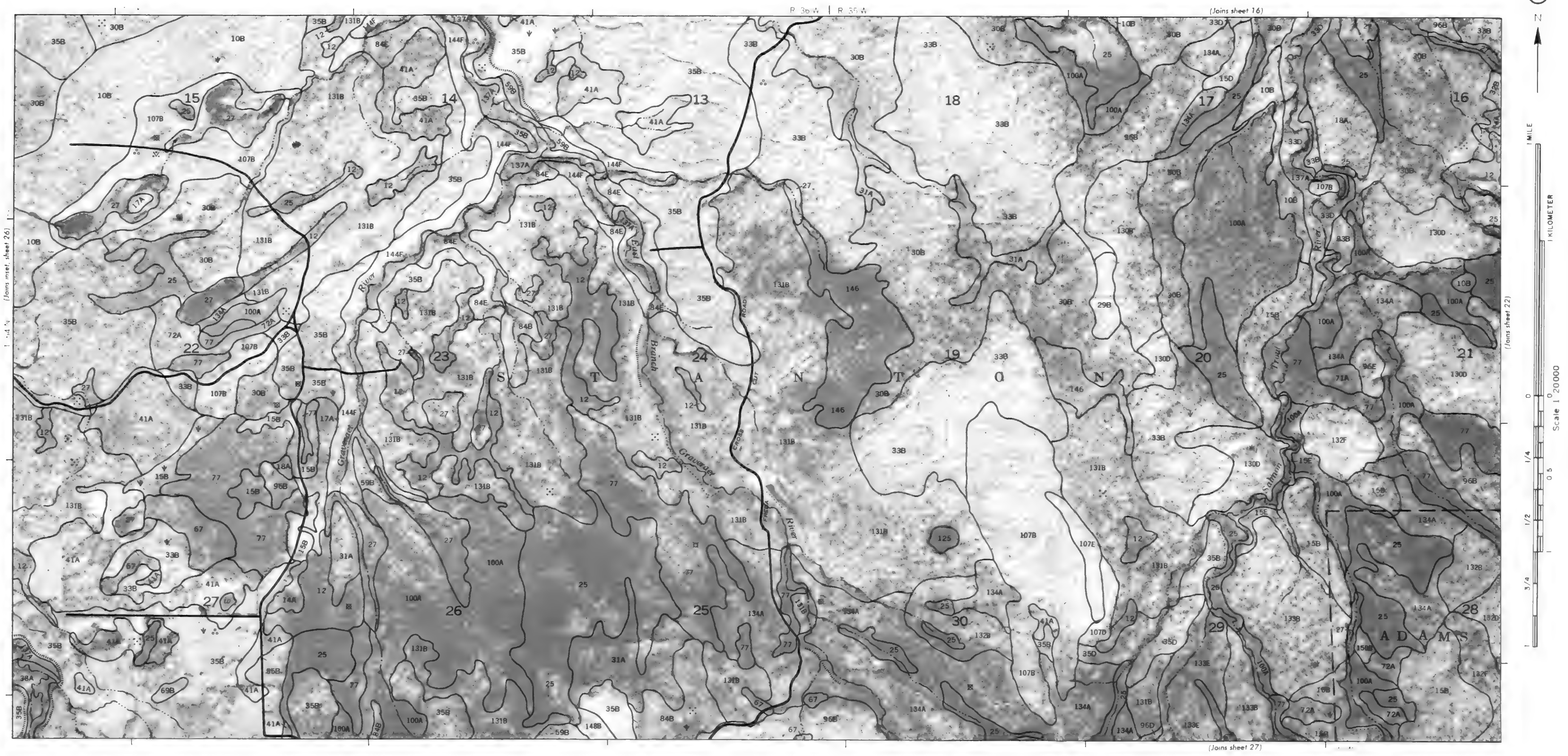



18
N
(Joins sheet 13)
R. 34 W. | R. 33 W.
HANCOCK
PORTAGE LAKE
HOUGHTON
(county seat)
MICHIGAN TECHNOLOGICAL UNIVERSITY
FRANKLIN
Dollar Bay
OSCEOLA
FOREST HILL CEMETERY
Hurontown
Atlantic Mine
Dodgeville
Pilgrim Point
Pilgrim River
PORTAGE
PORTAGE LAKE
T. 55 N. | T. 54 N.
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 23)
1 MILE
1 KILOMETER
Scale 1:20000
1 600 000 FEET
DENTON ROAD


(Joins sheet 14)
R. 33 W. | R. 32 W.
T. 55 N.
T. 54 N.
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 24)
Dollar Bay
O S C E O L A
T O R C H L A K E
Senter
TORCH BAY
Point Mills
PORTAGE LAKE
P O R T A G E L A K E
Grosse Point
Dreamland
N
1 MILE
1 KILOMETER
Scale 1:20000

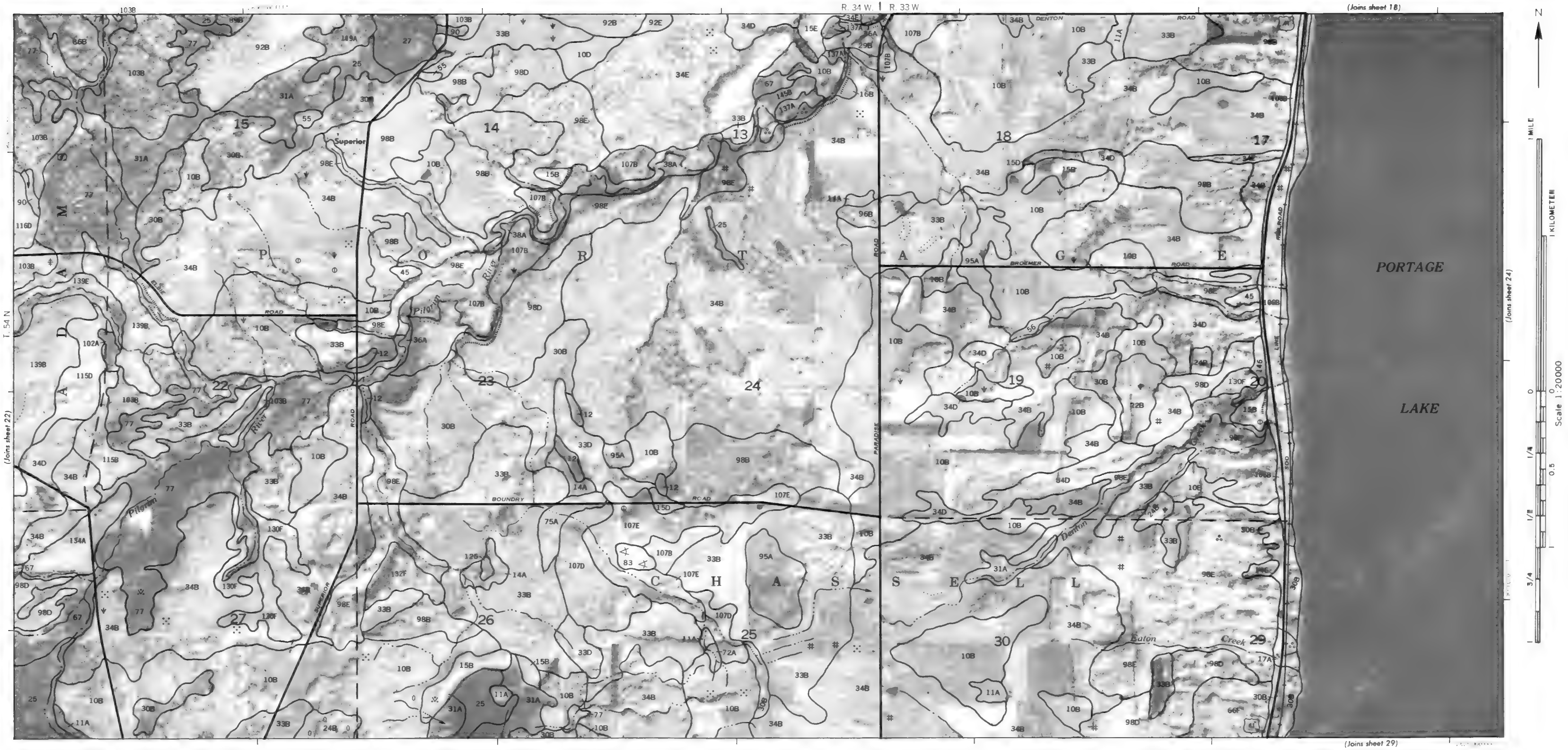
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 20




R. 36 W. | R. 35 W.
(Joins sheet 16)
(Joins sheet 22)
(Joins sheet 27)
(Joins inset, sheet 26)
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
S T A N T O N
A D A M S
Graveraet River
East Branch Graveraet River
Salmon Trout River
River
CROSS CUT ROAD
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

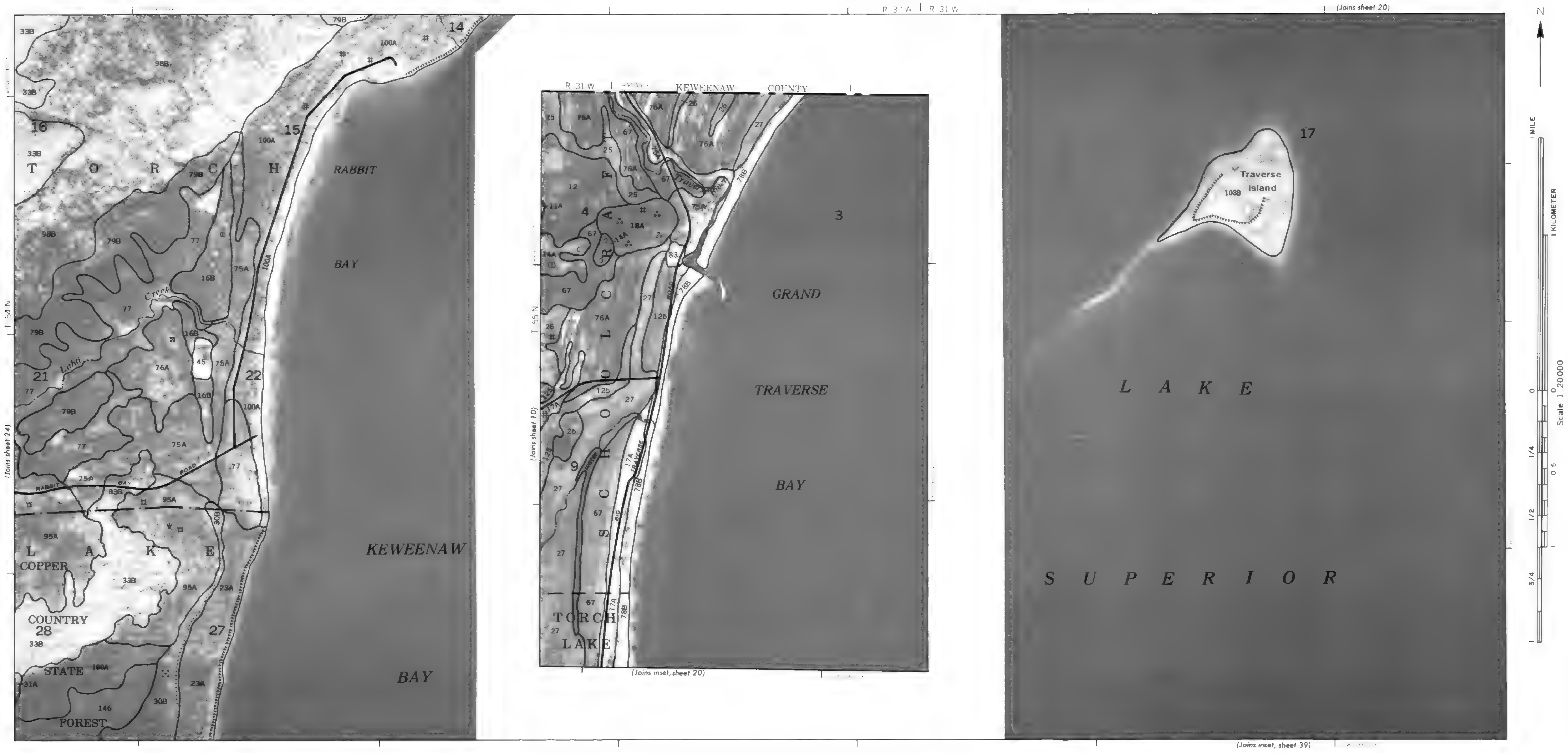

22
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 17)
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 28)
R. 35 W. | R. 34 W.
T. 54 N.
S T A N T O N
A D A M S
P O R T A G E
South Range
Baltic
Trimountain
Painesdale
Big Valley Creek
Branch
Elsie Road
15
14
13
18
17
16
22
23
24
19
20
21
27
26
25
30
29
28

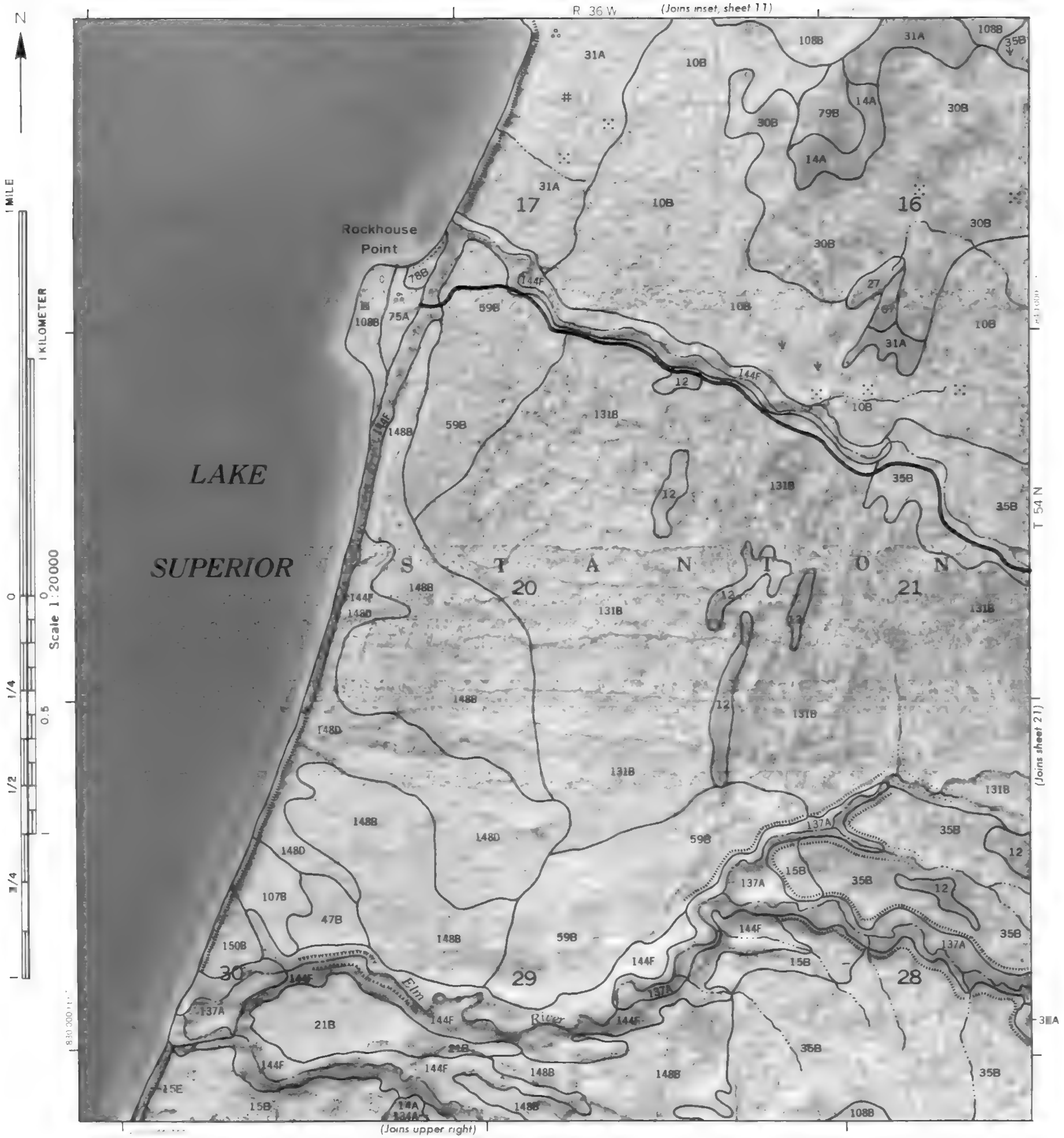
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 23

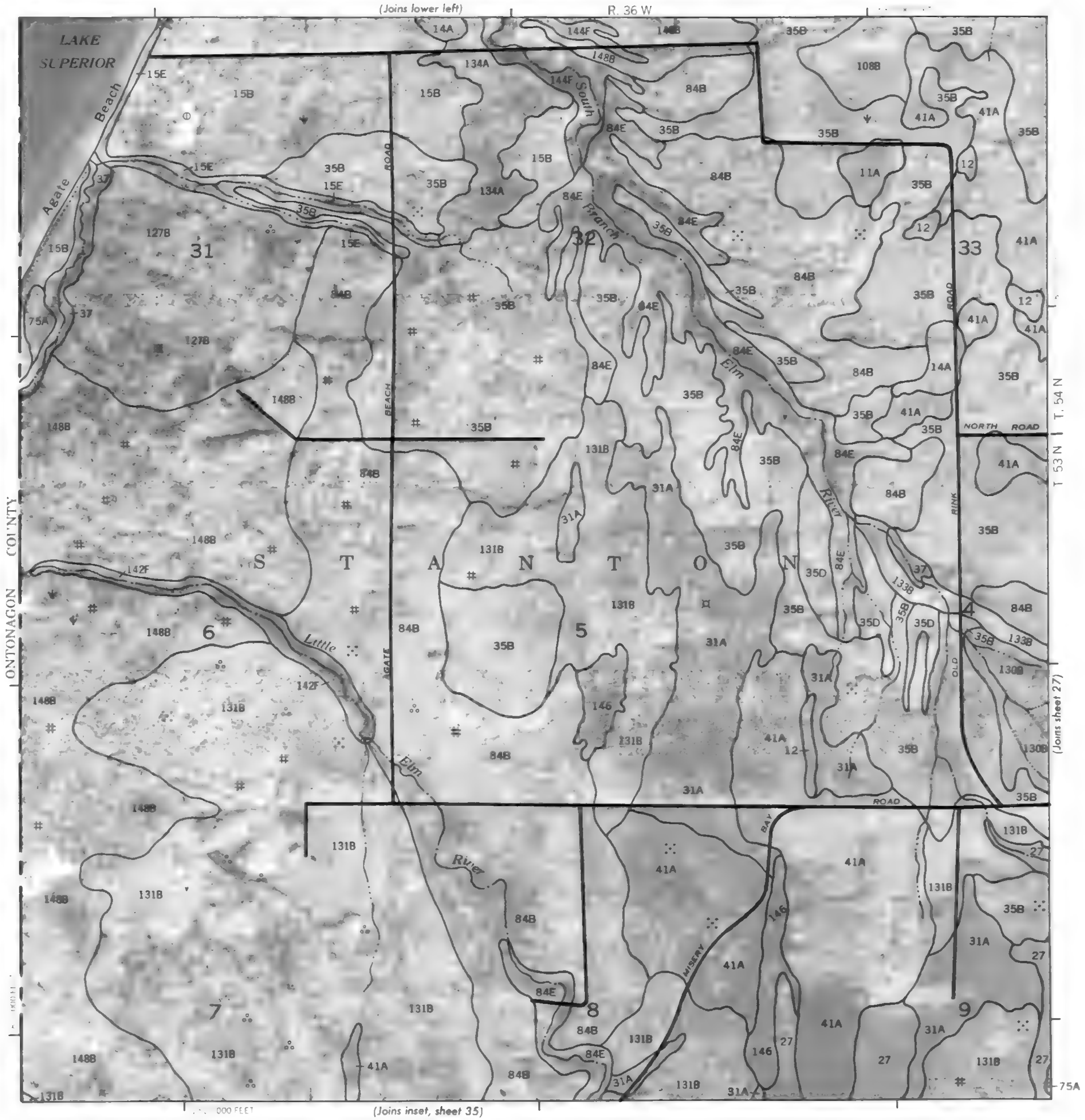


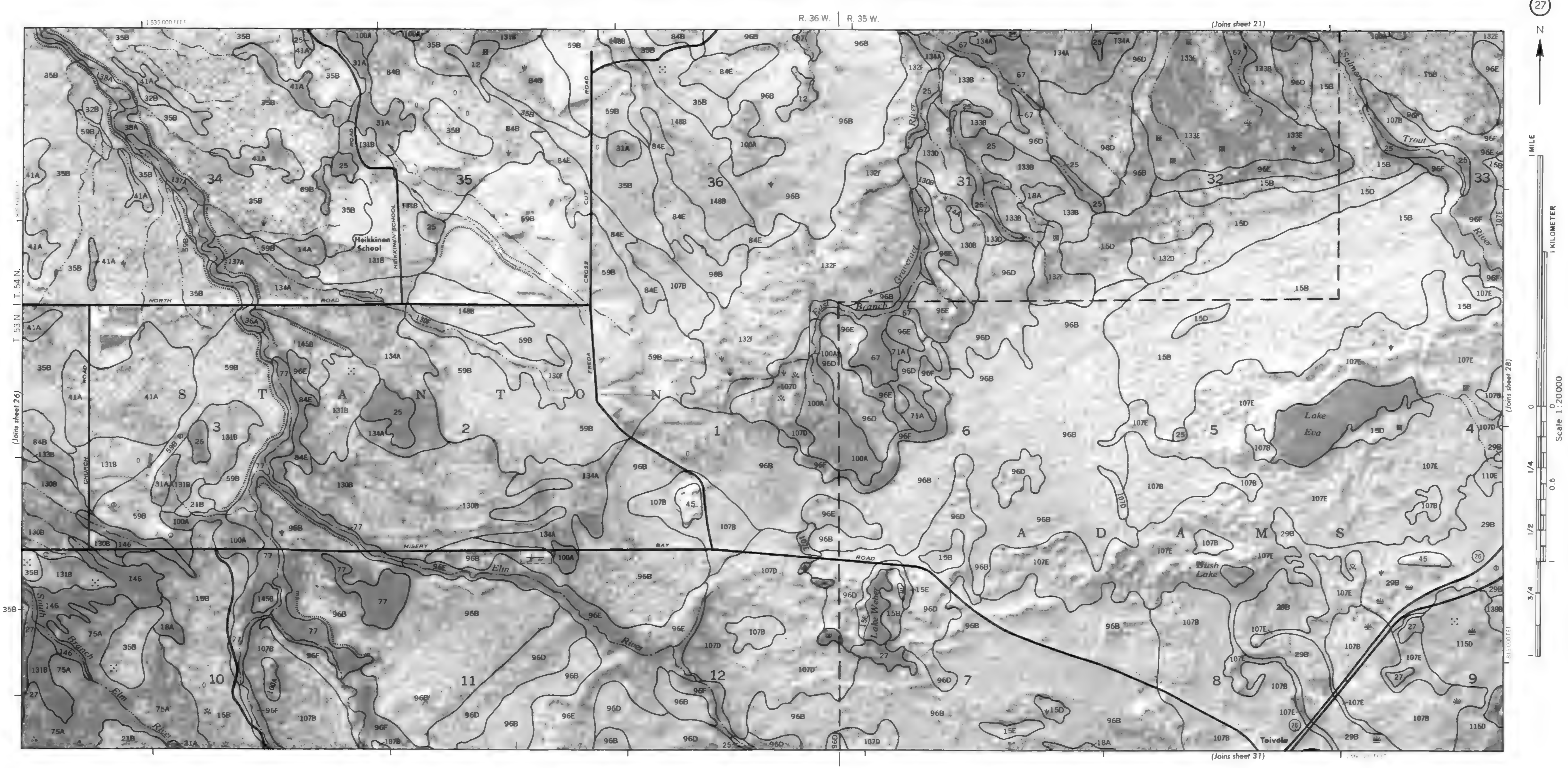
(24)

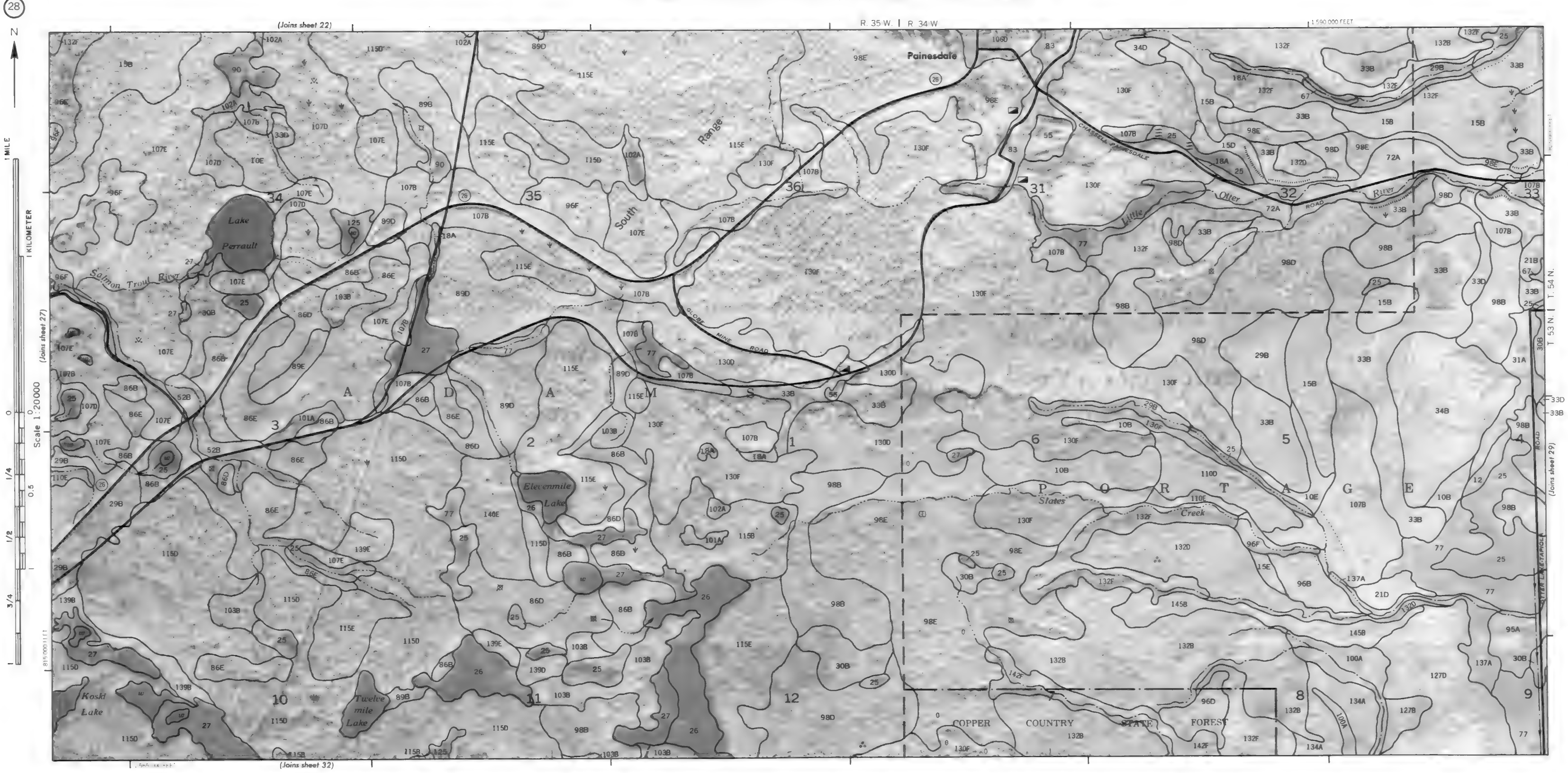
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 24


25
(Joins sheet 20)
(Joins sheet 24)
(Joins sheet 10)
(Joins inset, sheet 20)
(Joins inset, sheet 39)
R 31 W
KEWEENAW COUNTY
T 54 N.
T 55 N.
TORCH
RABBIT
BAY
KEWEENAW
BAY
LAKE
COPPER
COUNTRY
STATE
FOREST
Lahti
Creek
RABBIT BAY ROAD
TORCH LAKE
SCHOOLCRAFT
GRAND
TRAVERSE
BAY
Traverse River
BIG TRAVERSE ROAD
Traverse Island
LAKE
SUPERIOR
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5


N
1 MILE
1 KILOMETER
Scale 1:20000
R. 36 W.
(Joins inset, sheet 11)
LAKE
SUPERIOR
Rockhouse
Point
S T A N T O N
17
16
20
21
29
28
30
Elm River
T. 54 N.
(Joins sheet 21)
(Joins upper right)

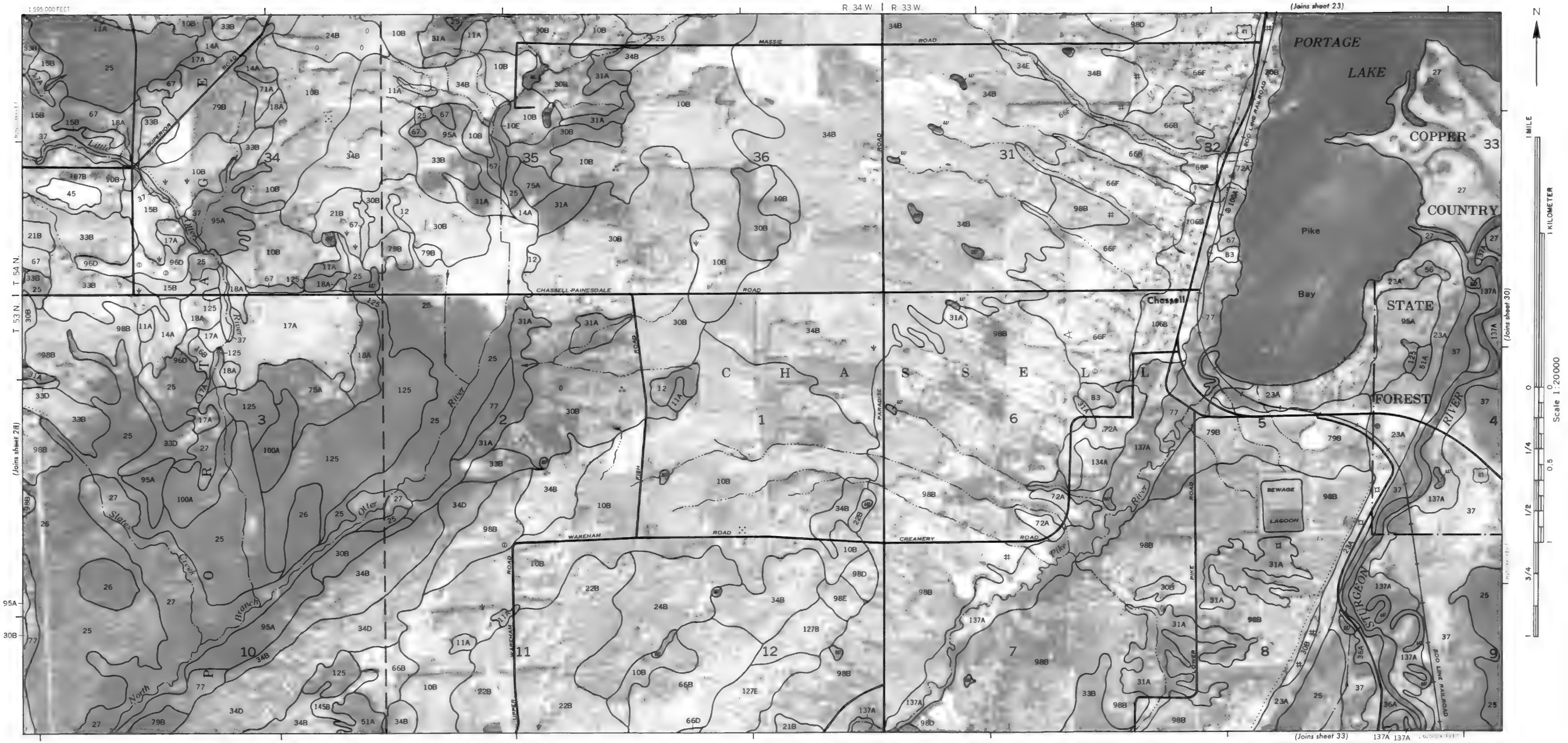

(Joins lower left)
R. 36 W.
LAKE
SUPERIOR
Agate Beach
South Branch
Elm River
Little Elm River
S T A N T O N
31
32
33
6
5
4
7
8
9
ONTONAGON COUNTY
BEACH ROAD
AGATE
NORTH ROAD
RINK ROAD
OLD
BAY
MISERY
ROAD
T. 54 N.
T. 53 N.
(Joins sheet 27)
(Joins inset, sheet 35)


27
R. 36 W. | R. 35 W.
(Joins sheet 21)
(Joins sheet 31)
(Joins sheet 26)
(Joins sheet 28)
T. 54 N.
T. 53 N.
S T A N T O N
A D A M S
Heikkinen School
NORTH ROAD
MISERY BAY ROAD
Lake Eva
Bush Lake
Lake Weber
Elm River
South Branch Elm River
East Branch Graveraet River
Salmon Trout River
Toivola
N
1 MILE
1 KILOMETER
Scale 1:20000

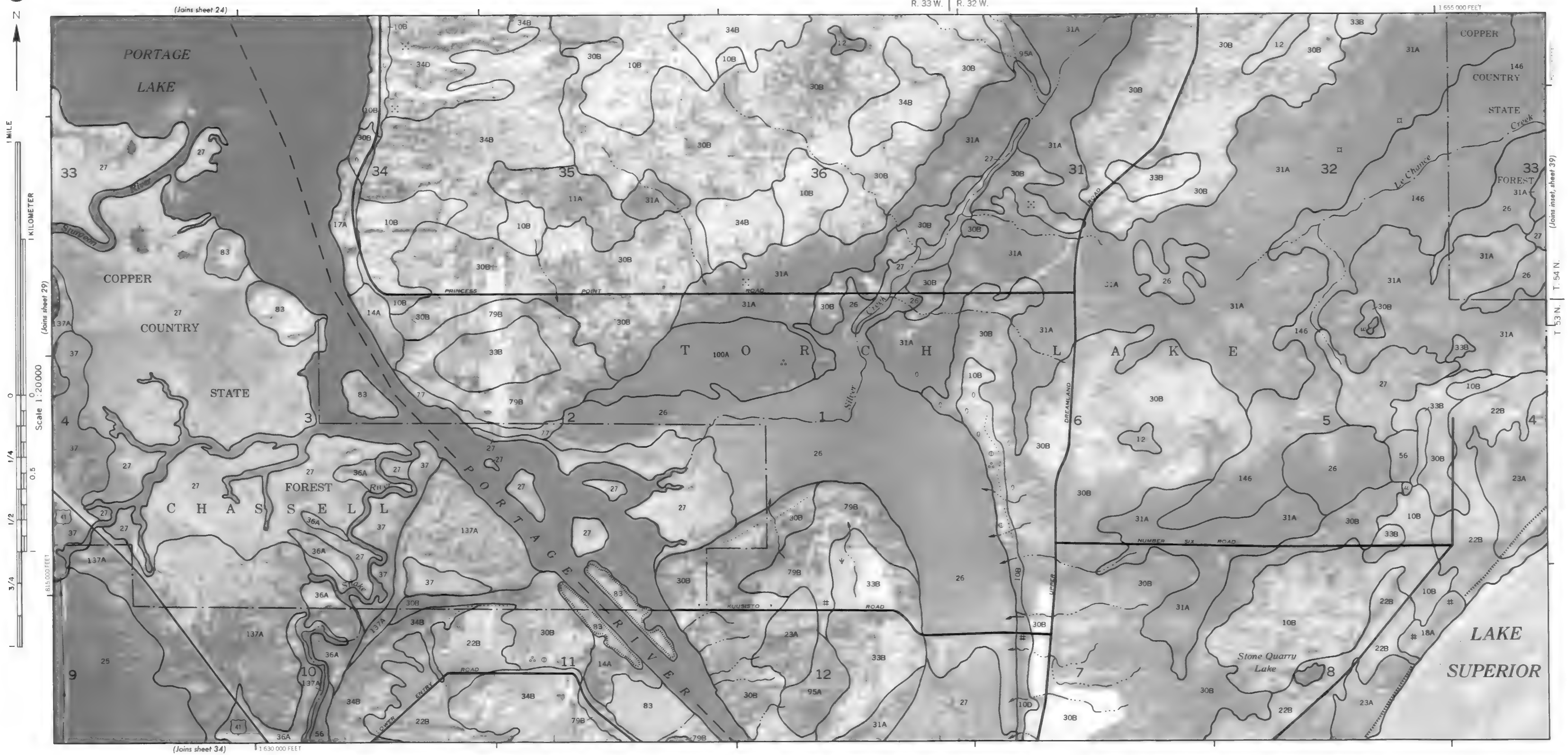

28
N
(Joins sheet 22)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 32)
R. 35 W. | R. 34 W.
T. 54 N.
T. 53 N.
1 590 000 FEET
Painesdale
Lake Perrault
Salmon Trout River
Elevenmile Lake
Twelvemile Lake
Koski Lake
South Range
GLOBE MINE ROAD
CHASSELL-PAINESDALE ROAD
Little Otter River
States Creek
A D A M S
P O R T A G E
COPPER COUNTRY STATE FOREST
1 MILE
1 KILOMETER
Scale 1:20000

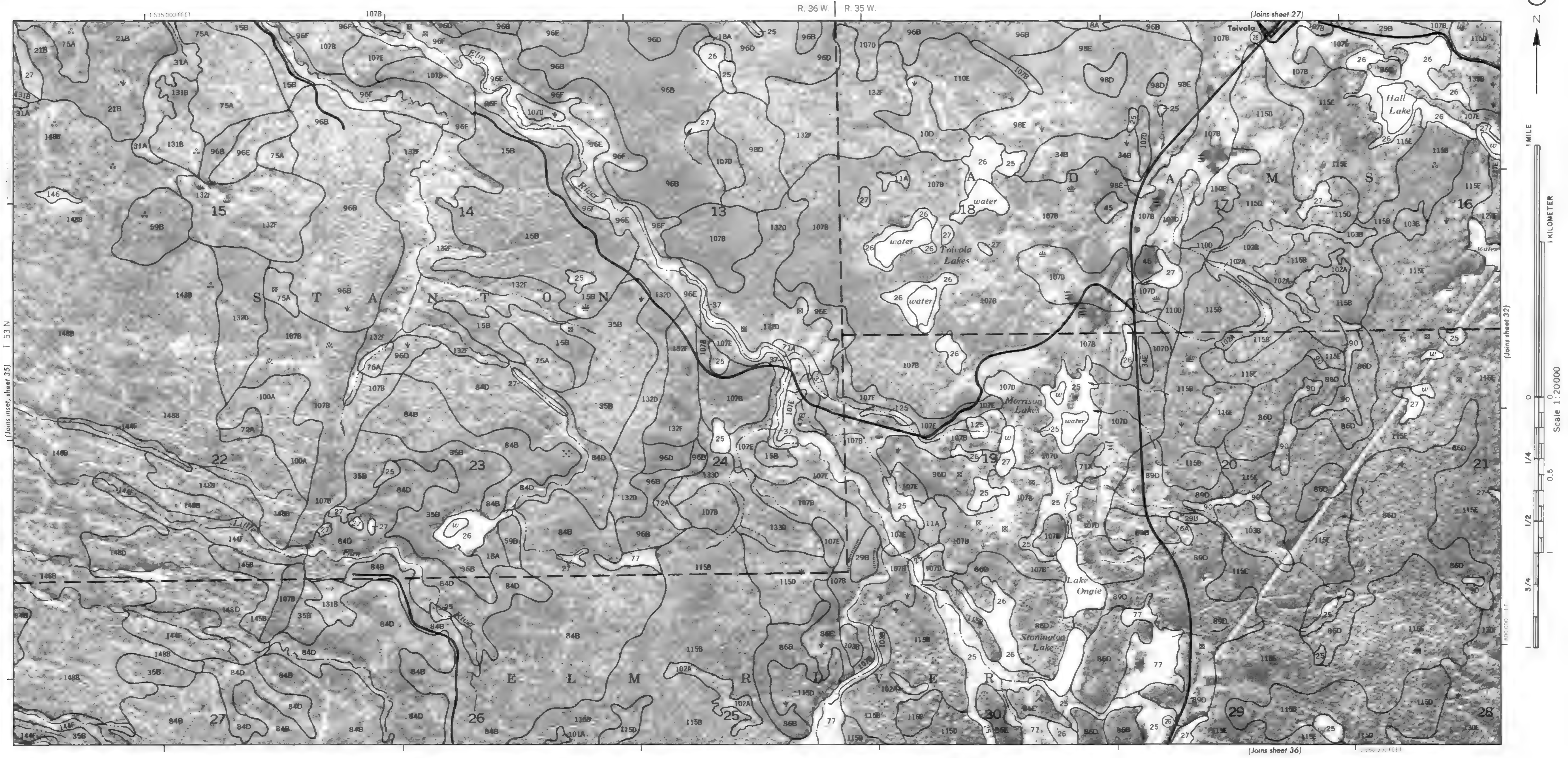
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 29

29

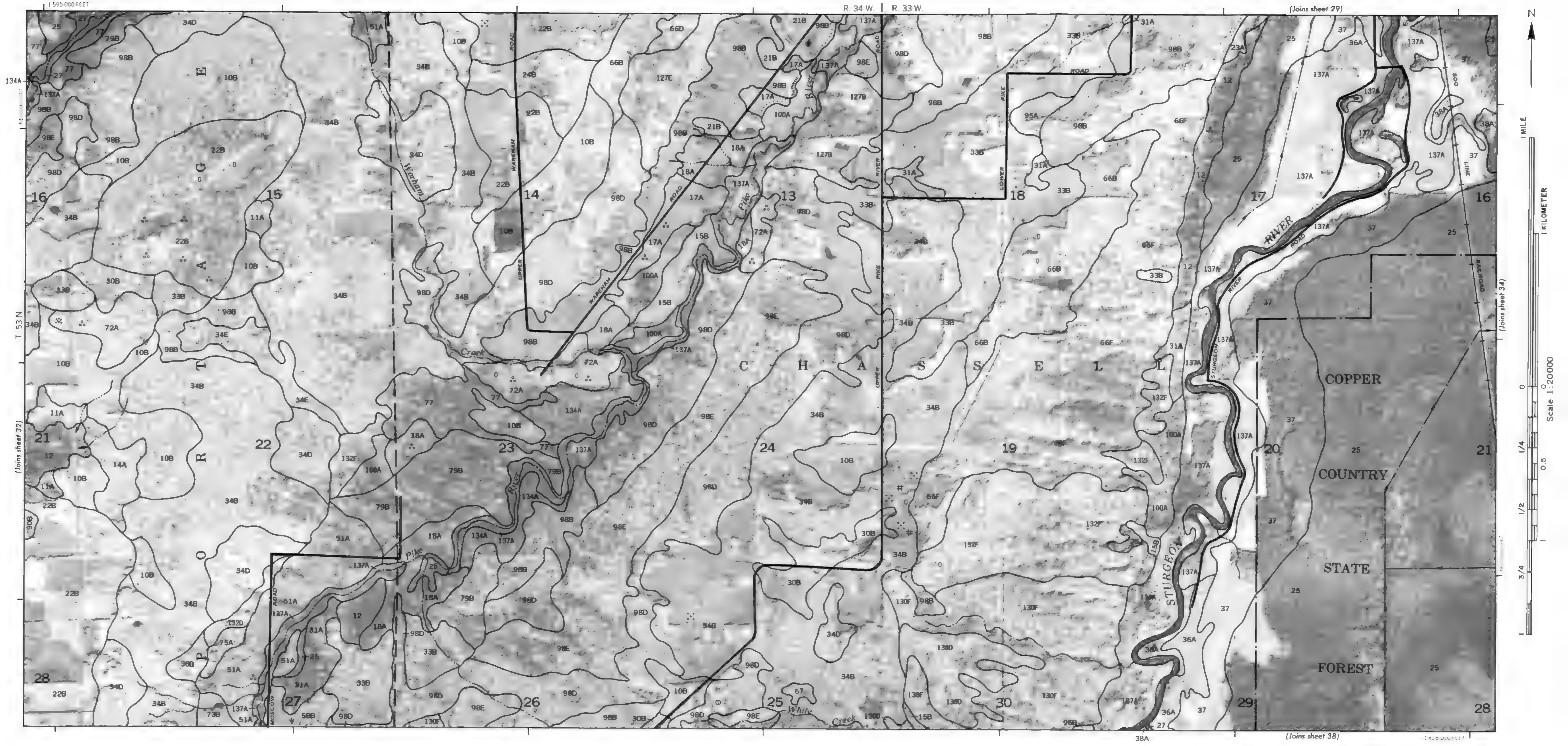


SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 30

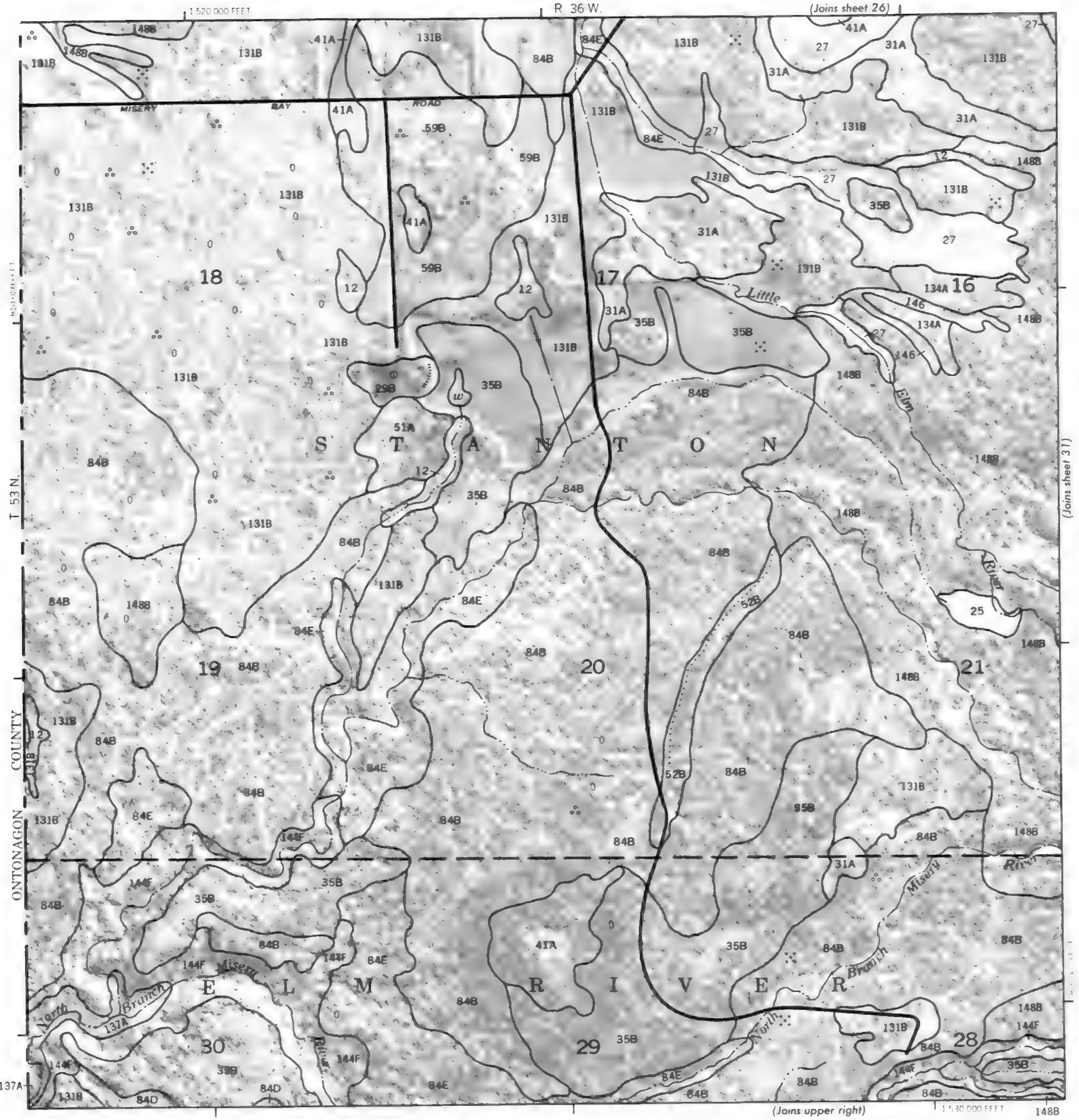


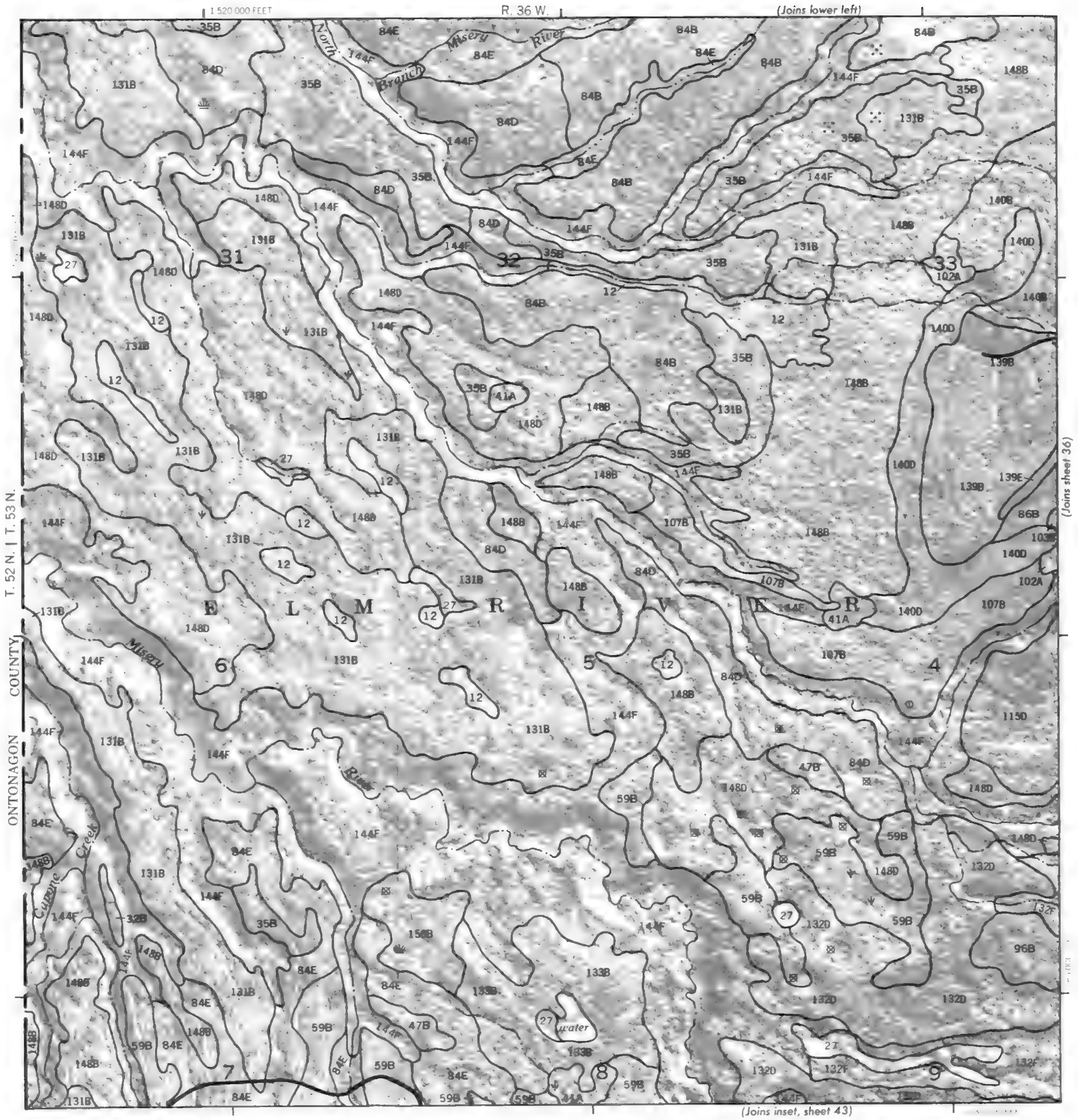

(Joins sheet 27)
(Joins sheet 32)
(Joins sheet 36)
(Joins inset, sheet 35)
R. 36 W.
R. 35 W.
T. 53 N.
Toivola
Elm
River
Little
Elm
River
Toivola Lakes
Morrison Lakes
Lake Ongie
Stonington Lake
Hall Lake
water
S T A N T O N
A D A M S
E L M
R D V E R
N
1 MILE
1 KILOMETER
Scale 1:20 000


N
(Joins sheet 28)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 37)
R. 35 W. | R. 34 W.
T. 53 N.
1 565 000 FEET
Scale 1:20000
1 MILE
1 KILOMETER
Thirteenmile Lake
water
Pine Lake
ADAMS
COPPER COUNTRY STATE FOREST
PORTAGE
ELM RIVER
Sturgeon River
North Branch Otter River
RIVER ROAD
OTTER LAKE TAPIOLA
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30


33
R. 34 W.
R. 33 W.
(Joins sheet 29)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 38)
T. 53 N.
PORTAGE
CHASSELL
COPPER
COUNTRY
STATE
FOREST
STURGEON RIVER
Pike River
Warham Creek
White Creek
WAREHAM ROAD
UPPER WAREHAM ROAD
UPPER PIKE RIVER ROAD
LOWER PIKE ROAD
MOSCOW ROAD
Scale 1:20000
1 MILE
1 KILOMETER


(Joins sheet 30)
(Joins sheet 33)
(Joins sheet 39)
R. 33 W.
R. 32 W.
T. 53 N.
N
1 MILE
1 KILOMETER
Scale 1:20000
C H A S S E L L
T O R C H L A K E
LAKE SUPERIOR
KEWEENAW
BAY
COPPER
COUNTRY
STATE
FOREST
PORTAGE
RIVER
White City
Jacobsville
SOO LINE RAILROAD
KLINGVILLE ROAD
ENTRY ROAD





N

1 MILE

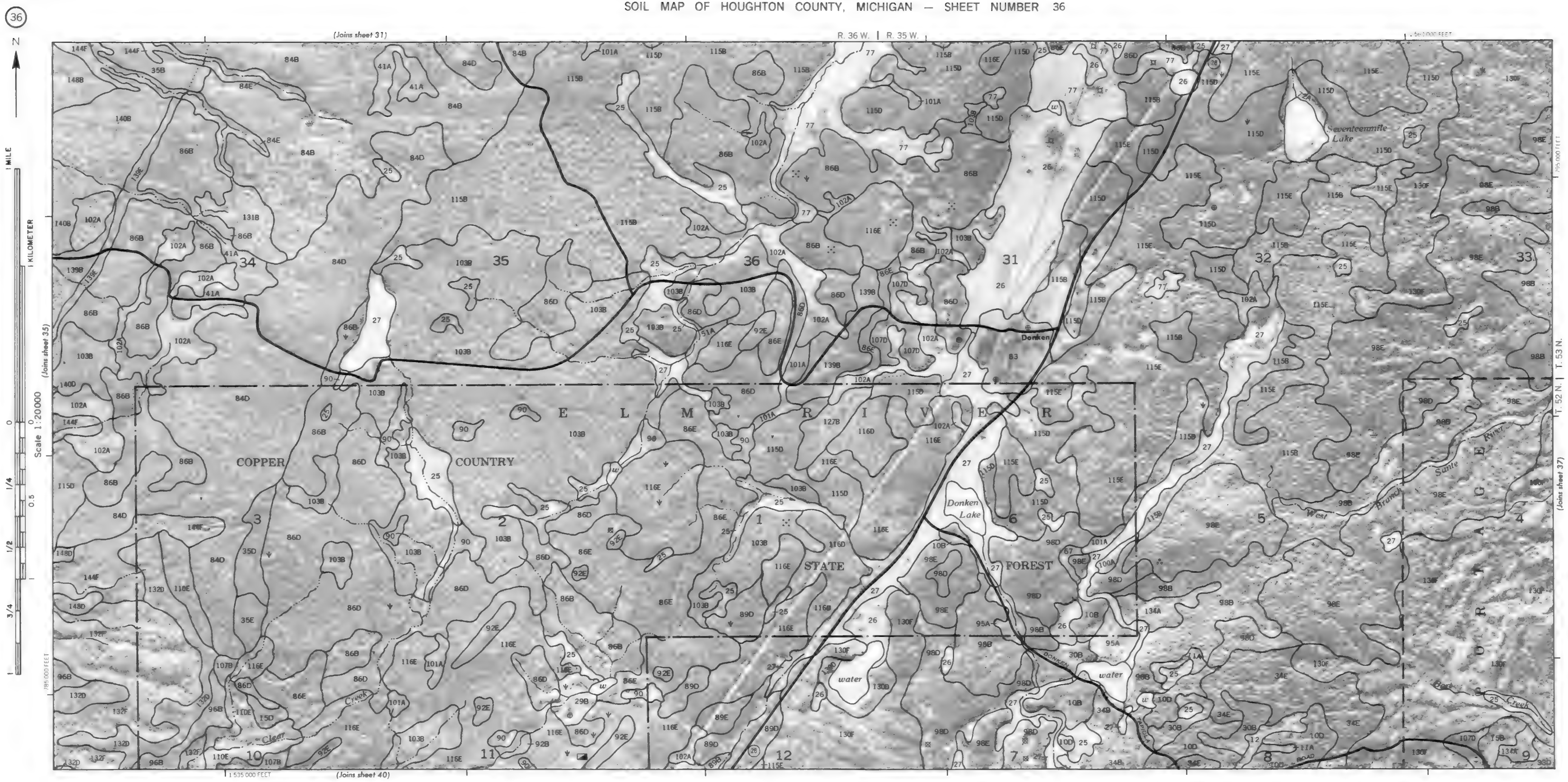
1 KILOMETER

Scale 1:20000

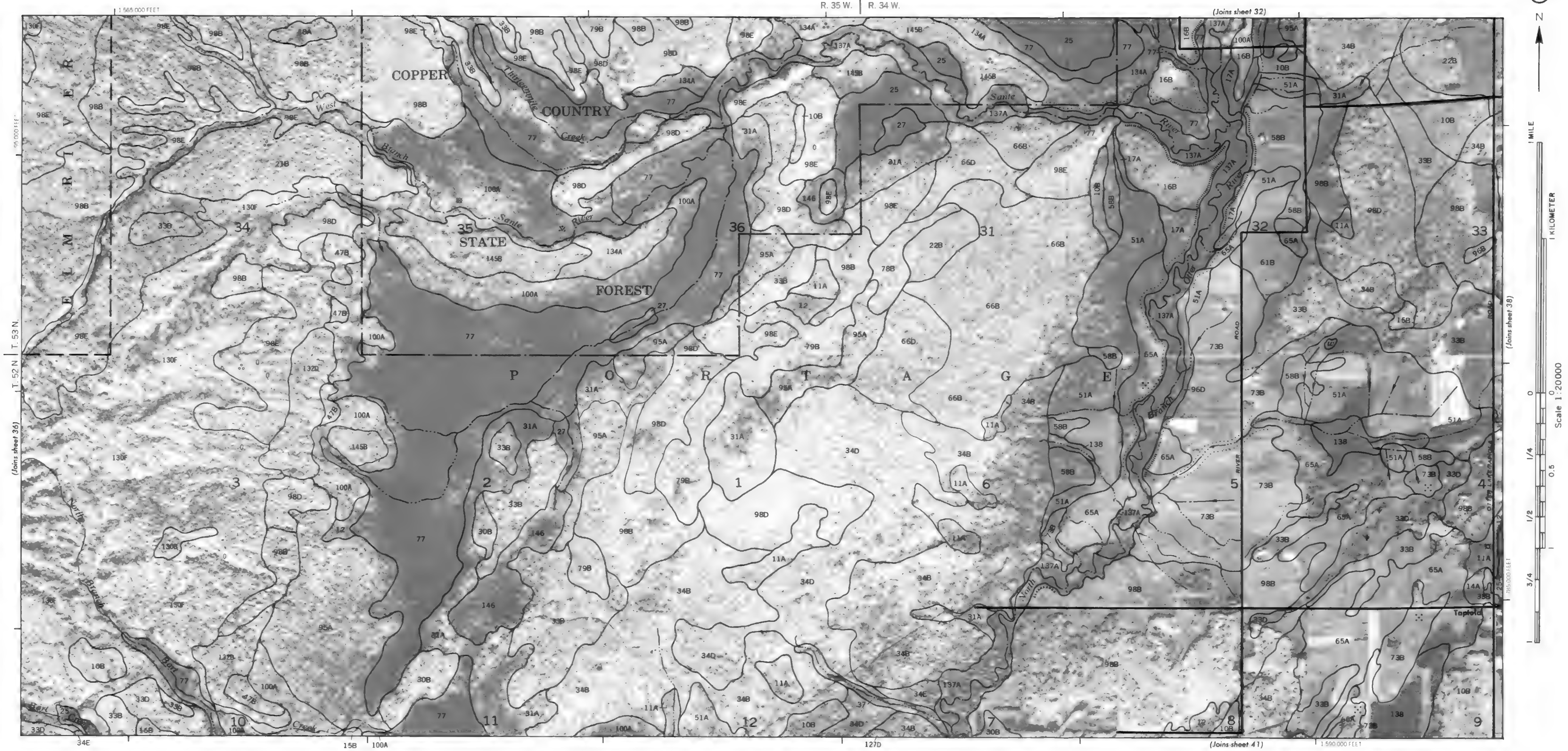
0 1/4 1/2 3/4

0 0.5

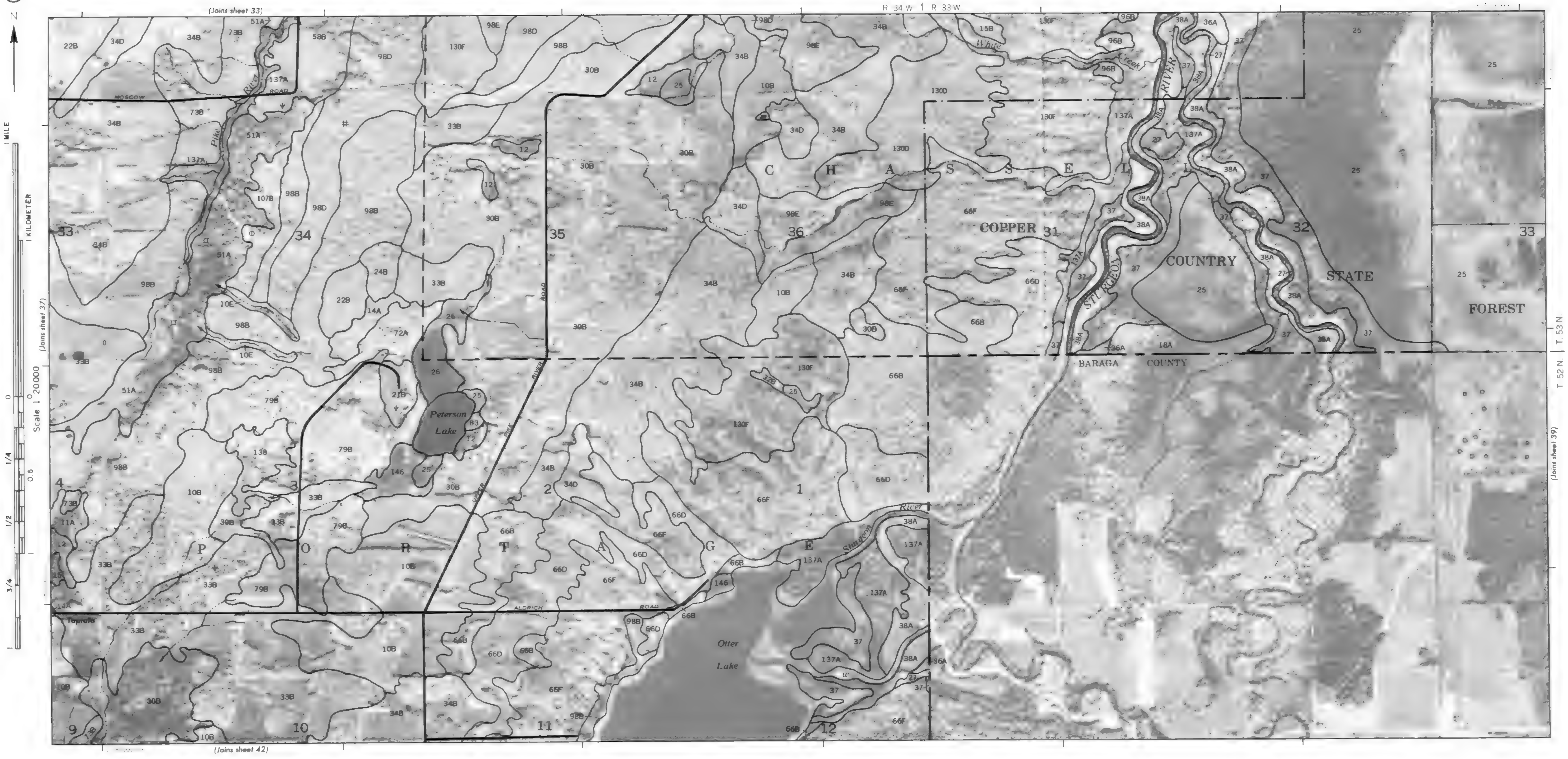
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 36

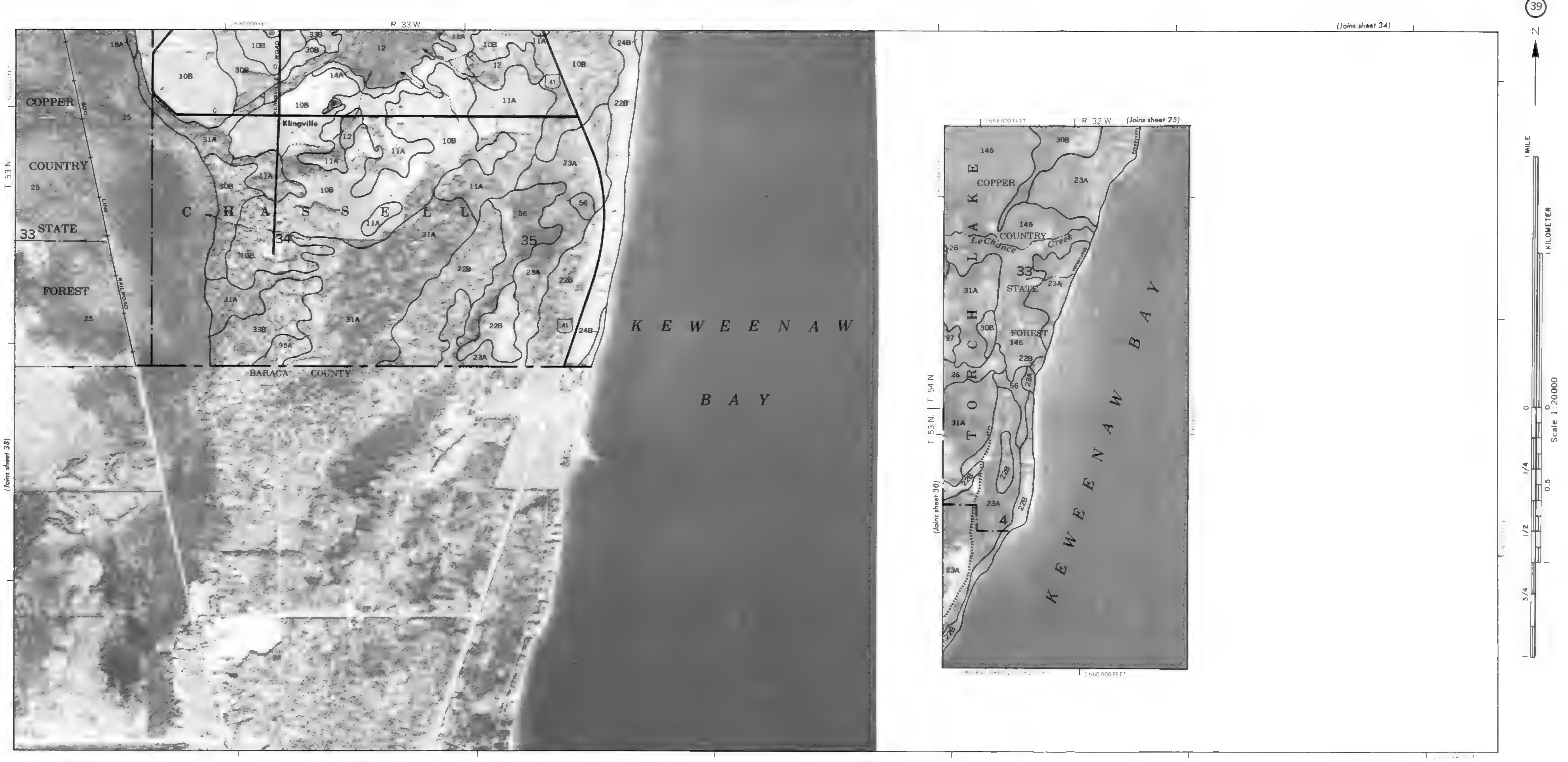


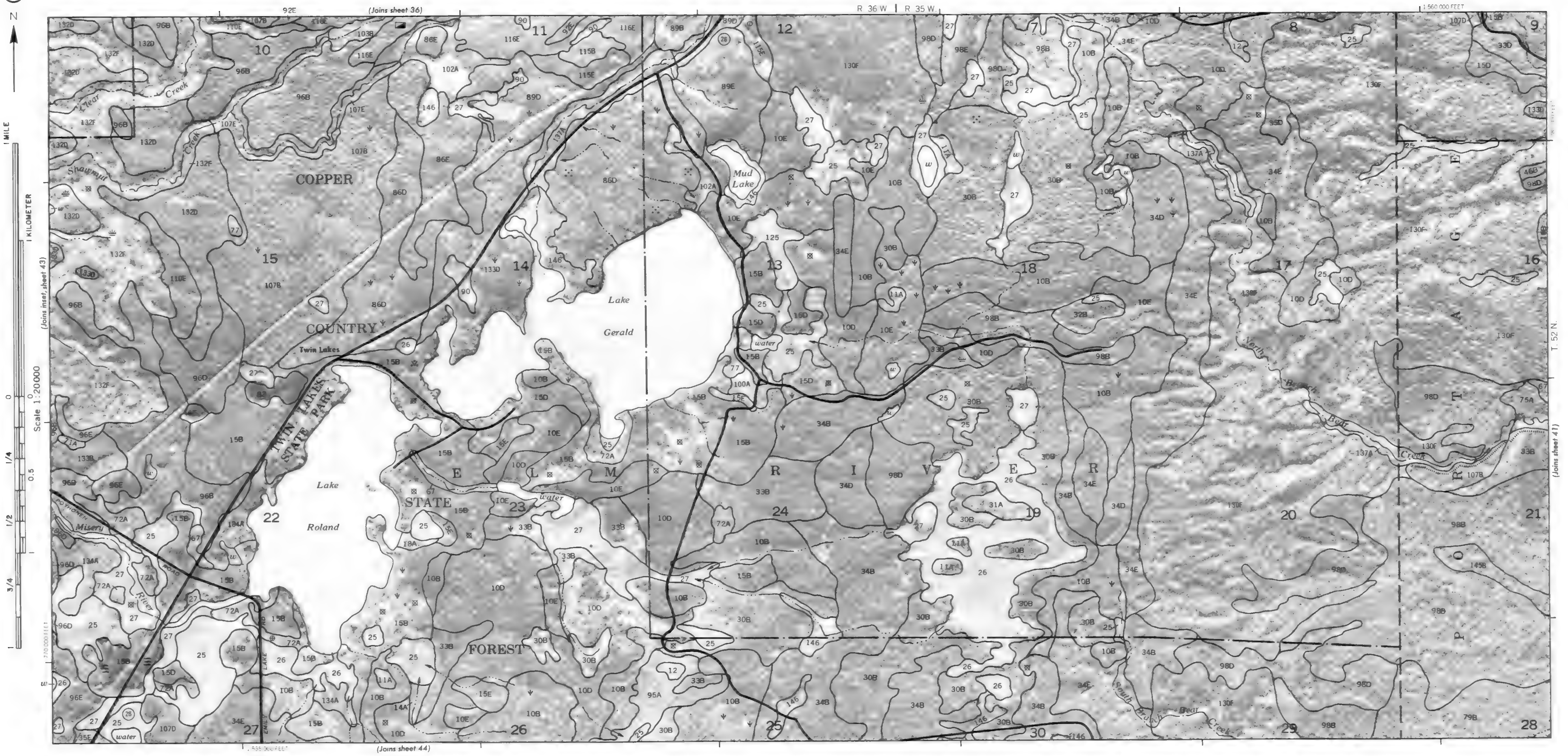
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 37



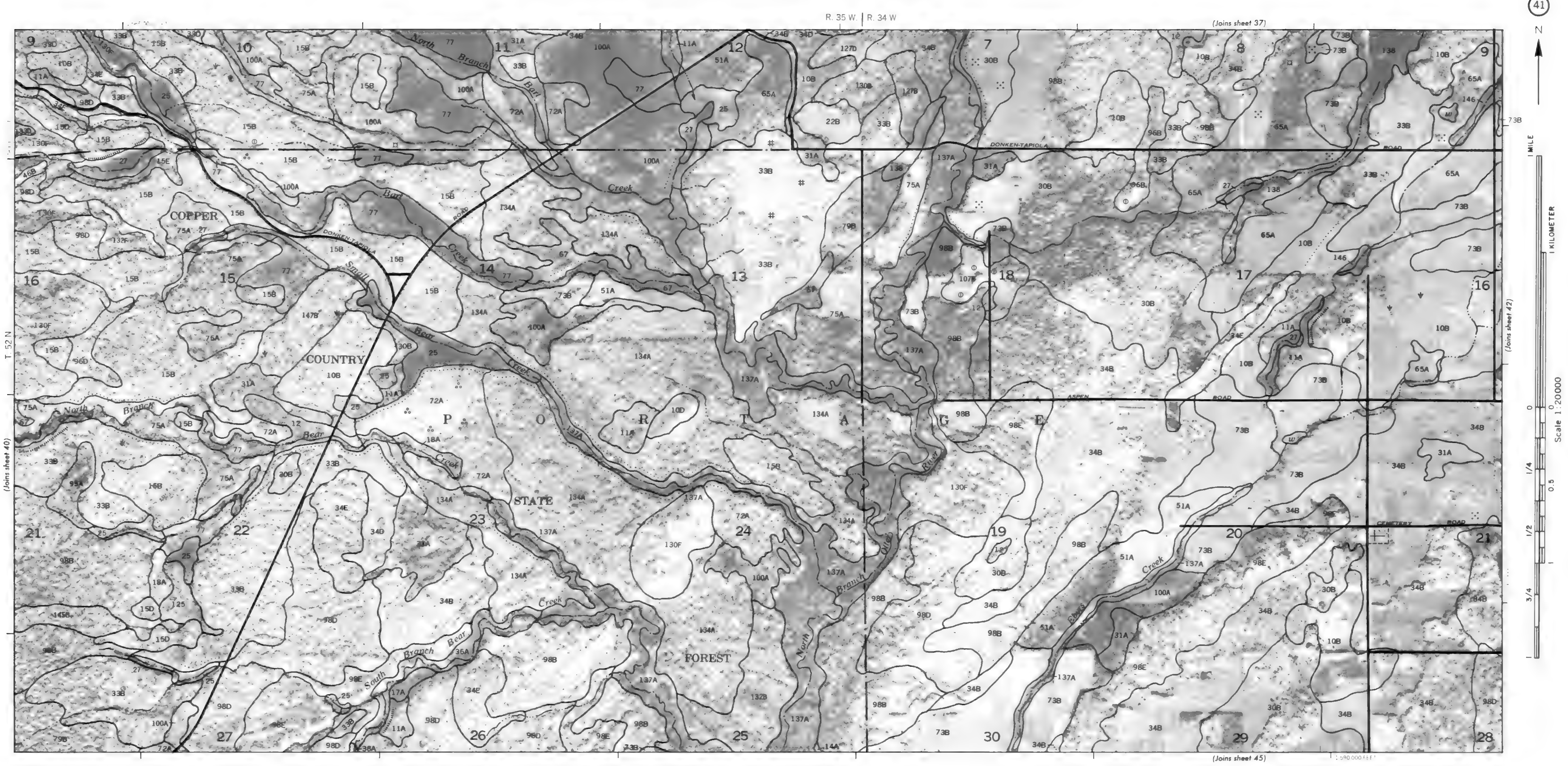
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 38

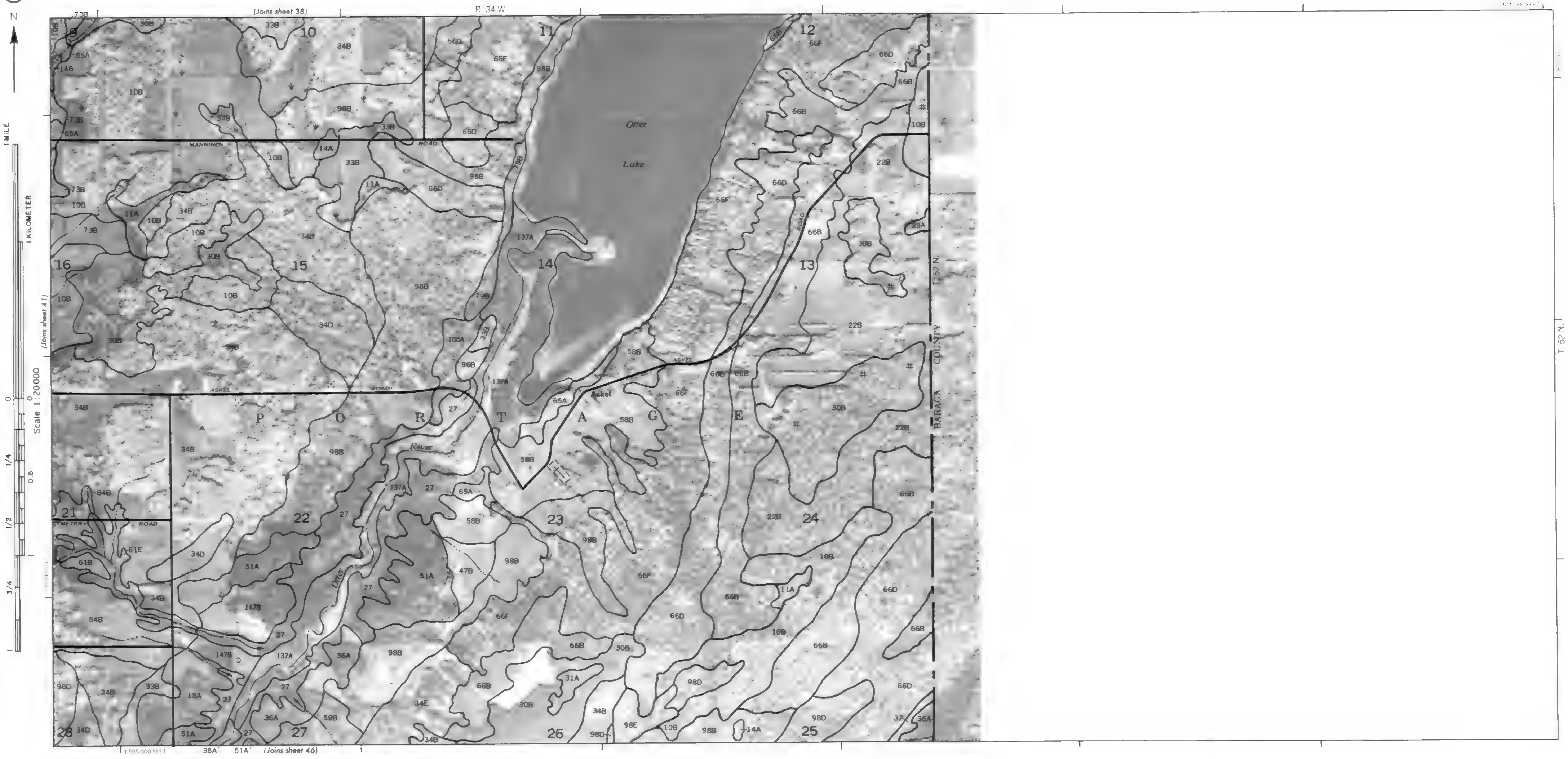



39
N
R 33 W
(Joins sheet 34)
(Joins sheet 38)
T 53 N
COPPER
COUNTRY
STATE
FOREST
SOO LINE RAILROAD
KLINGVILLE ROAD
Klingville
C H A S S E L L
33
34
35
BARAGA COUNTY
K E W E E N A W
B A Y
R 32 W
(Joins sheet 25)
(Joins sheet 30)
T 54 N.
T 53 N.
TORCH LAKE
LeChance Creek
K E W E E N A W B A Y
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

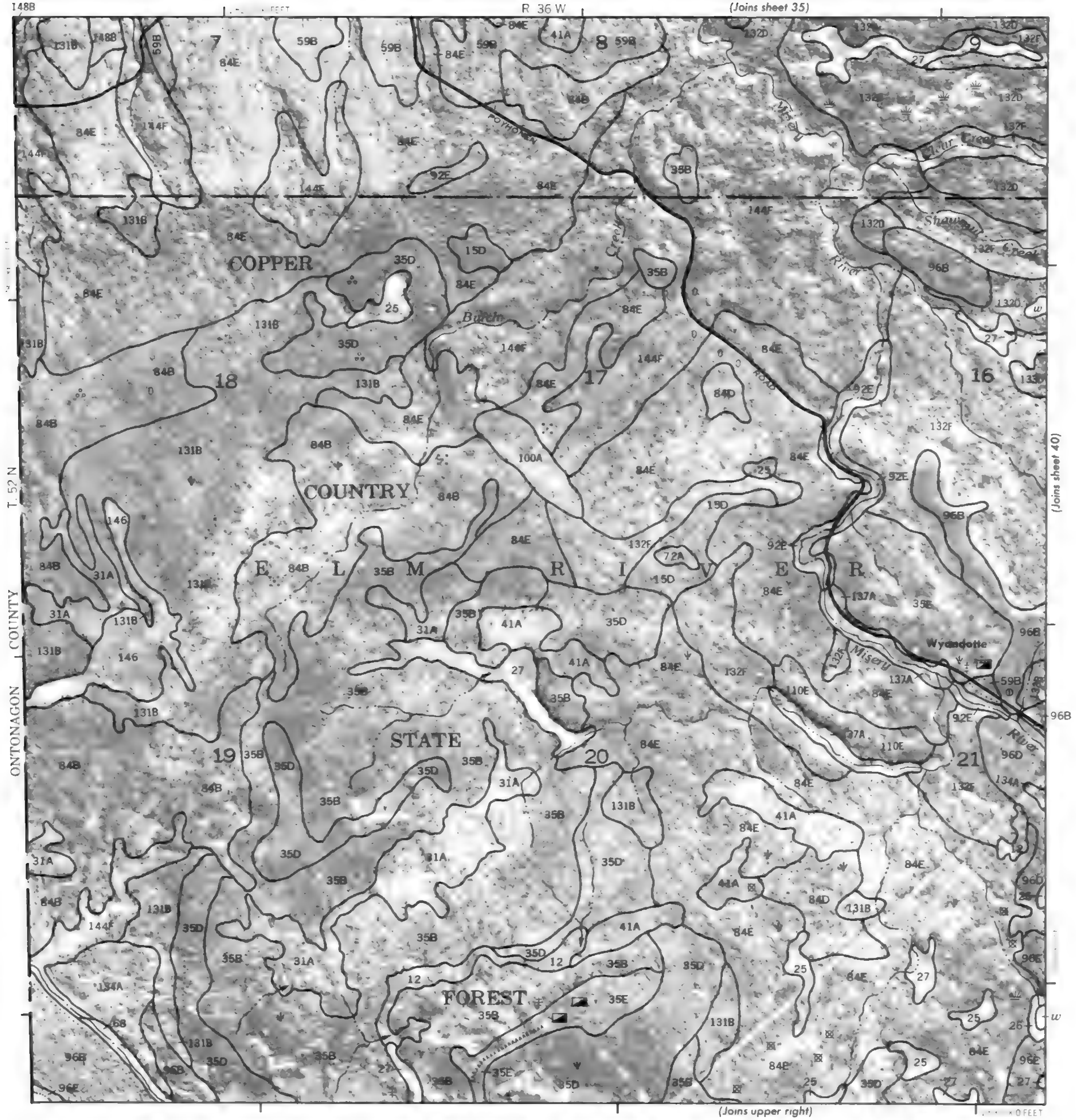

N
(Joins sheet 36)
(Joins sheet 44)
(Joins sheet 41)
(Joins inset, sheet 43)
R 36 W | R 35 W
T. 52 N.
1 560 000 FEET
Scale 1:20000
1 MILE
1 KILOMETER
COPPER COUNTRY STATE FOREST
ELM RIVER
TWIN LAKES STATE PARK
Twin Lakes
Lake Gerald
Lake Roland
Mud Lake
Clear Creek
Shawmut Creek
Misery River
North Branch Bear Creek
South Branch Bear Creek
water

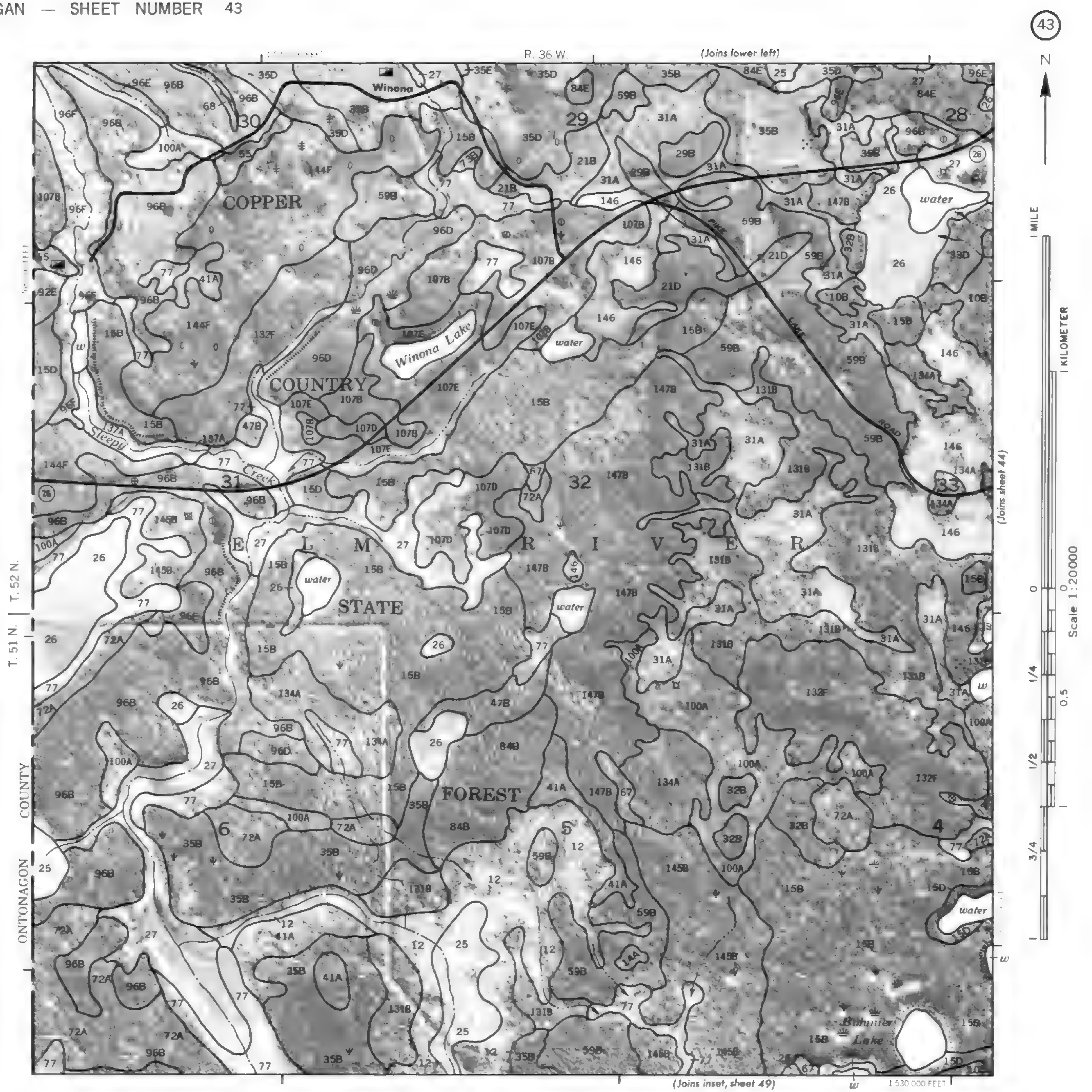
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 41




42
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 38)
(Joins sheet 41)
(Joins sheet 46)
R. 34 W.
T. 52 N.
Otter Lake
MANNINEN ROAD
ASKEL ROAD
CEMETERY ROAD
ROAD
Askel
Otter River
P O R T A G E
BARAGA COUNTY

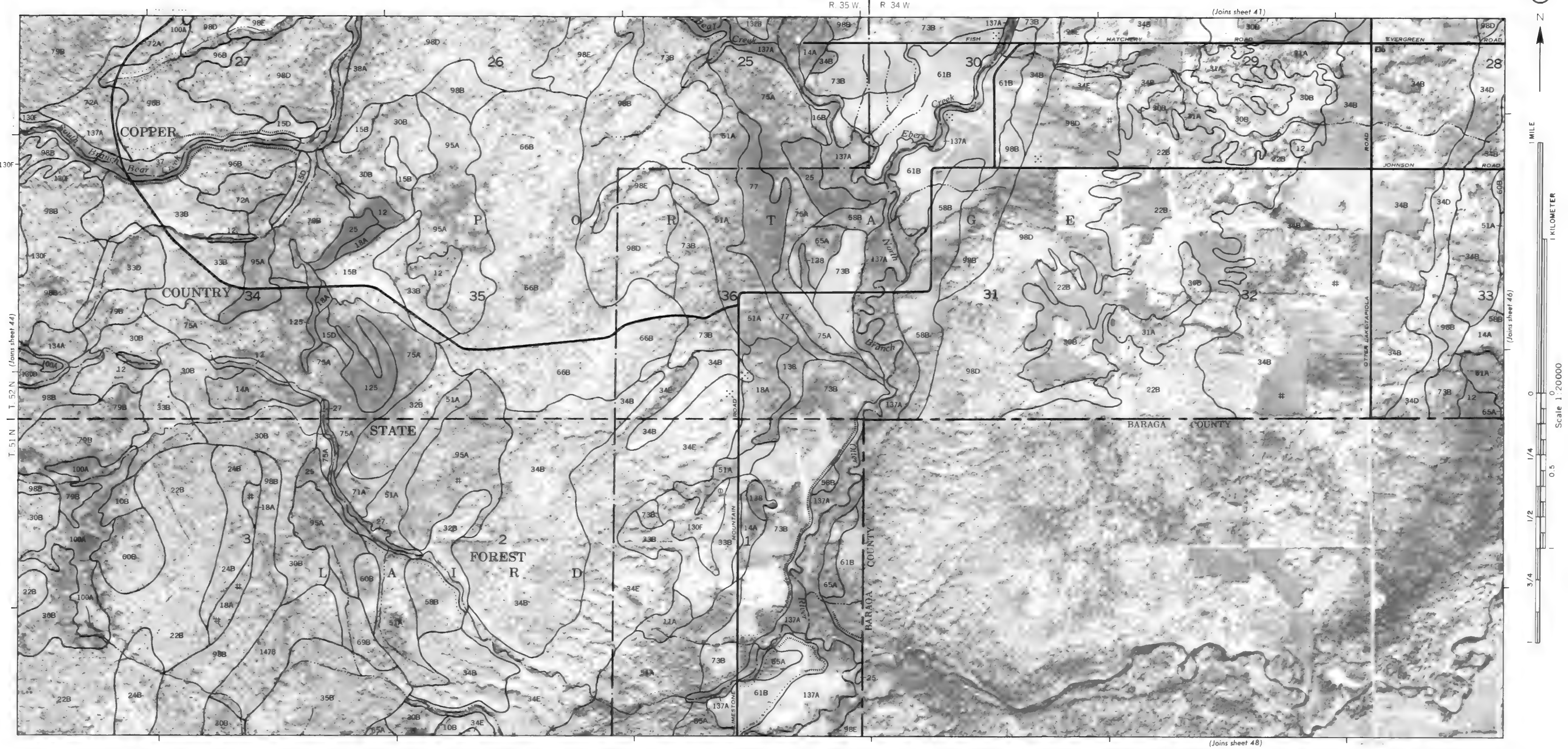
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 43



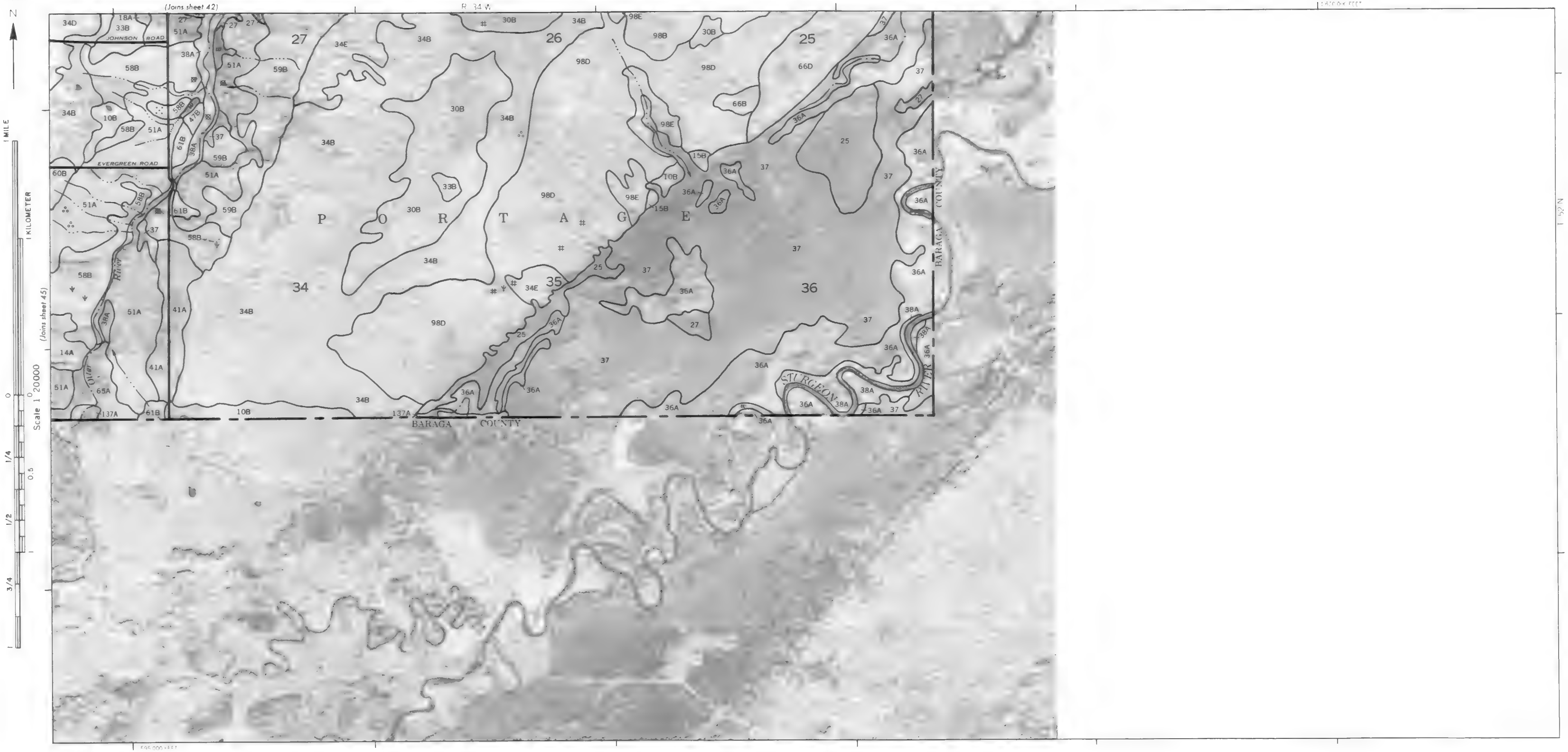


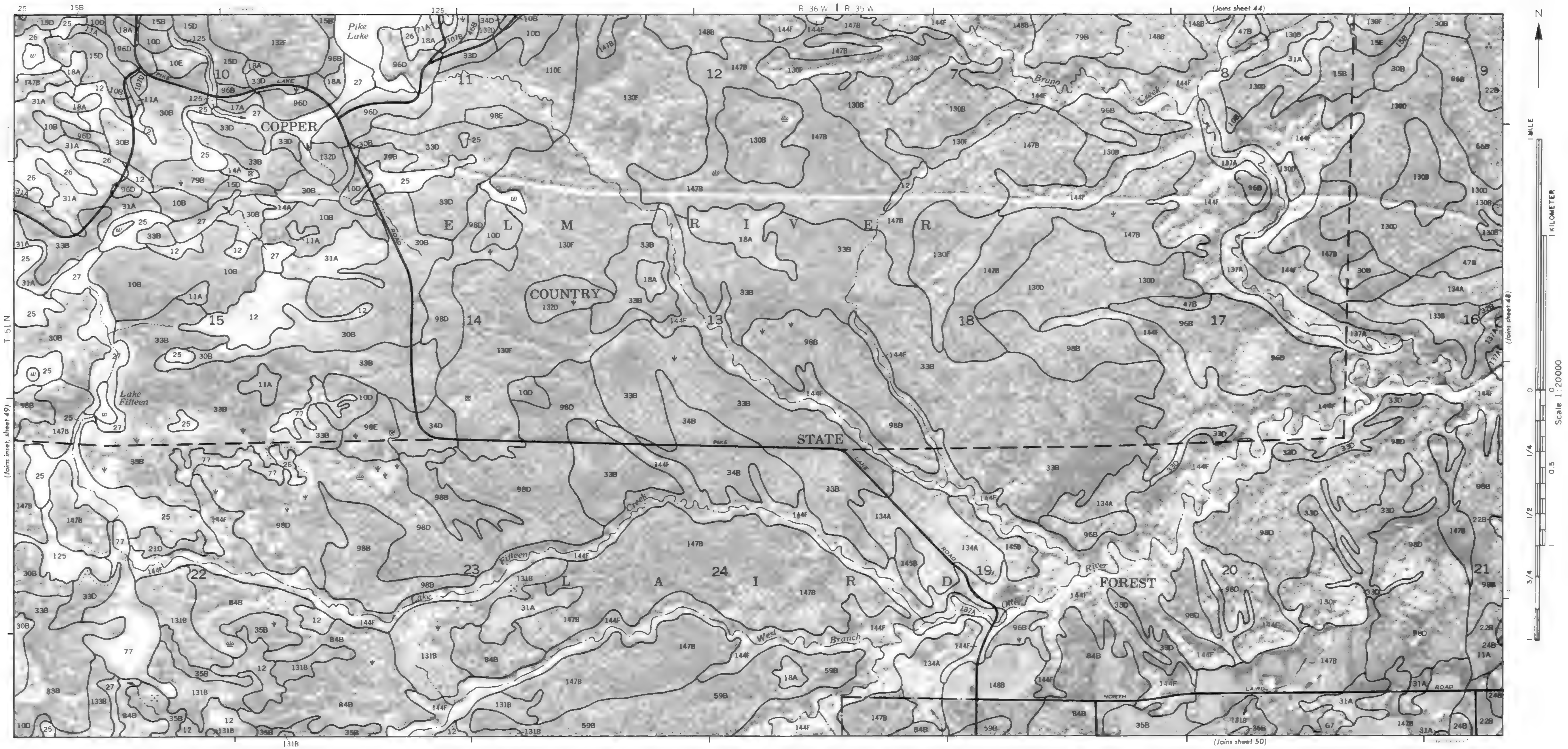

44
N
(Joins sheet 40)
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 47)
R 36 W | R 35 W
T 52 N | T 51 N
1 MILE
1 KILOMETER
Scale 1:20000
COPPER
COUNTRY
STATE
FOREST
E L M
R I V E R
P O R T A G E
L A I R D
Emily Lake
Sandy Lake
Clear Lake
Pike Lake
South Branch
Bear Creek
Bruno Creek
water
EMILY LAKE ROAD

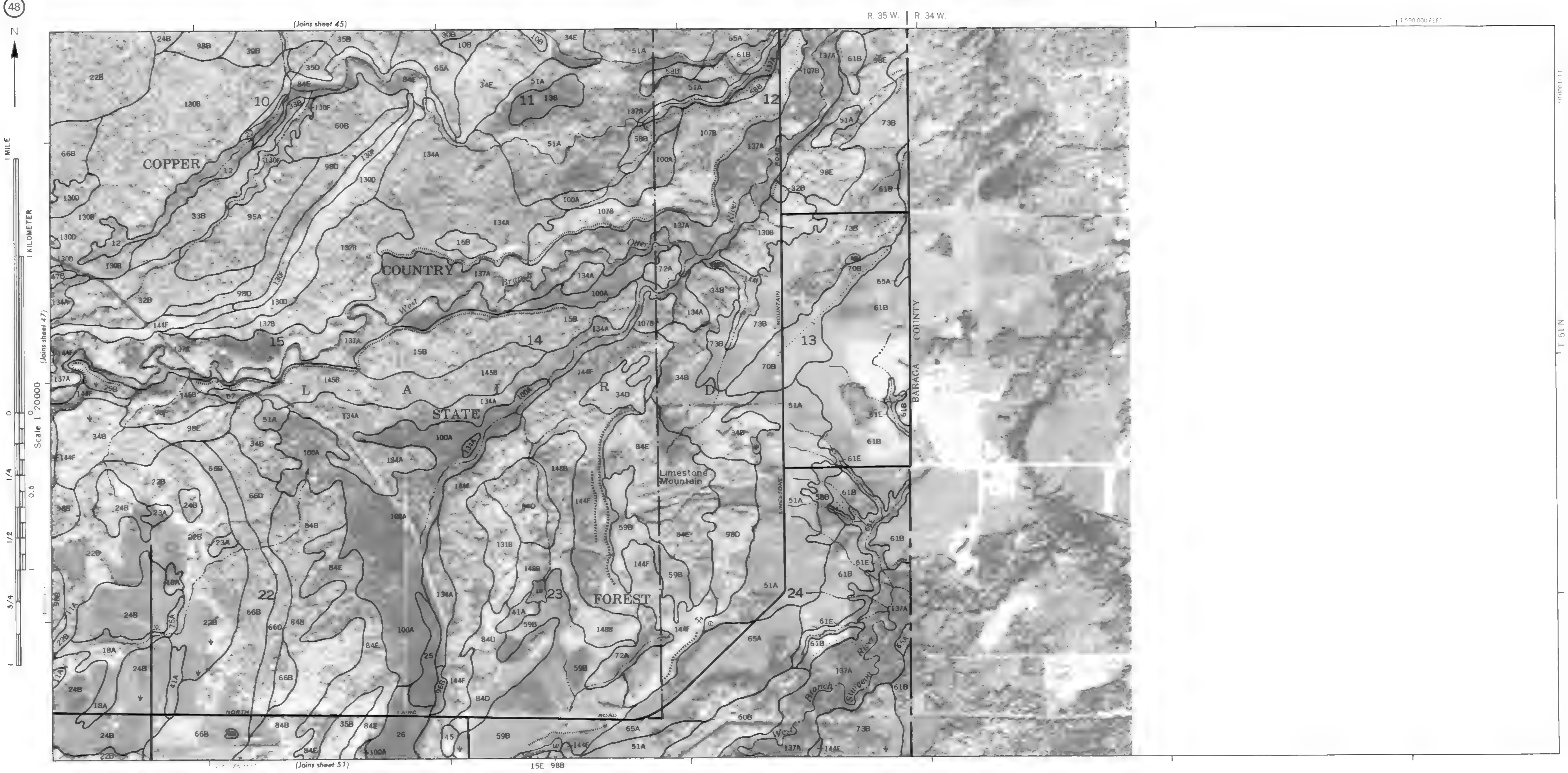
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 45



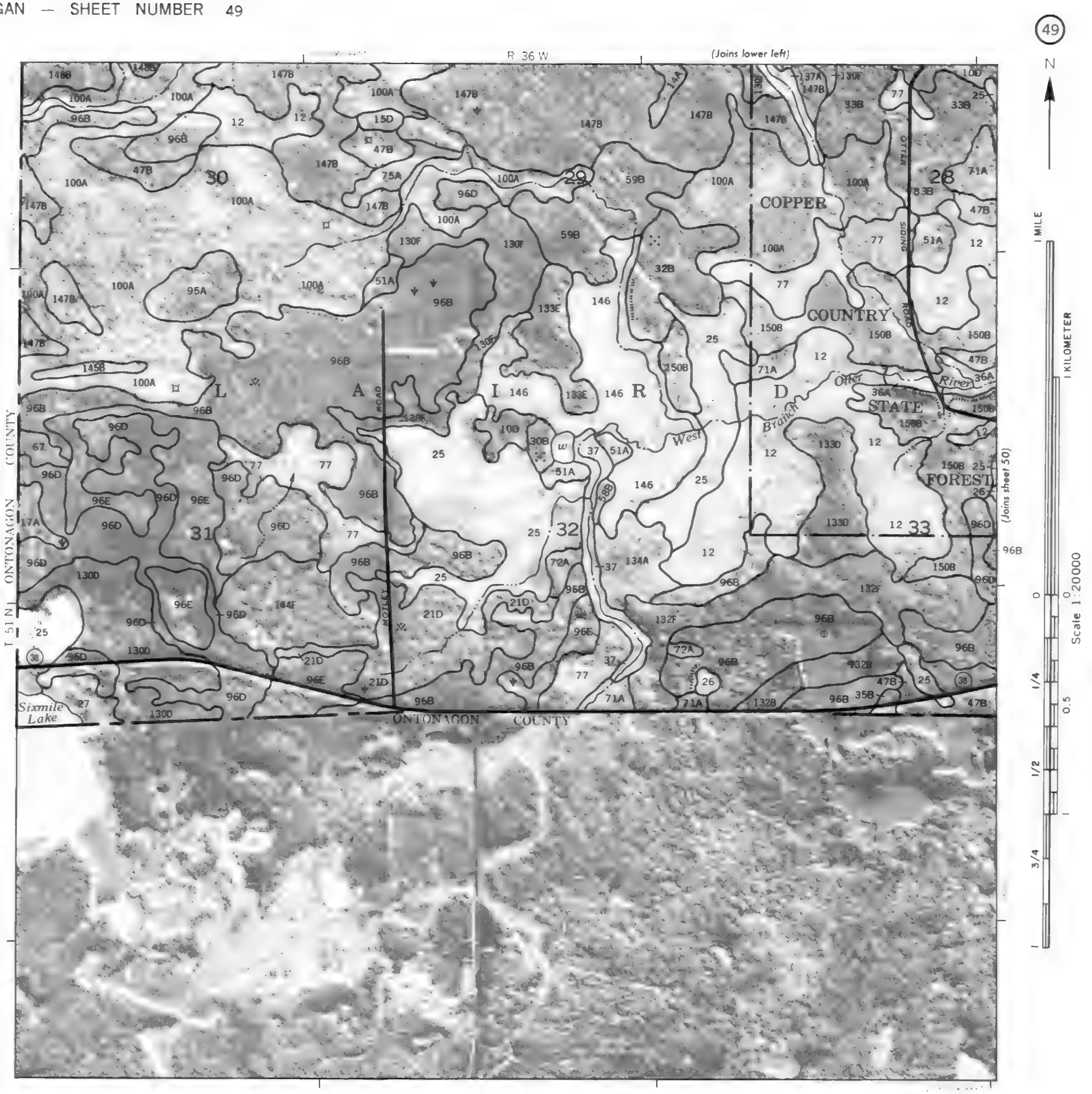
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 46

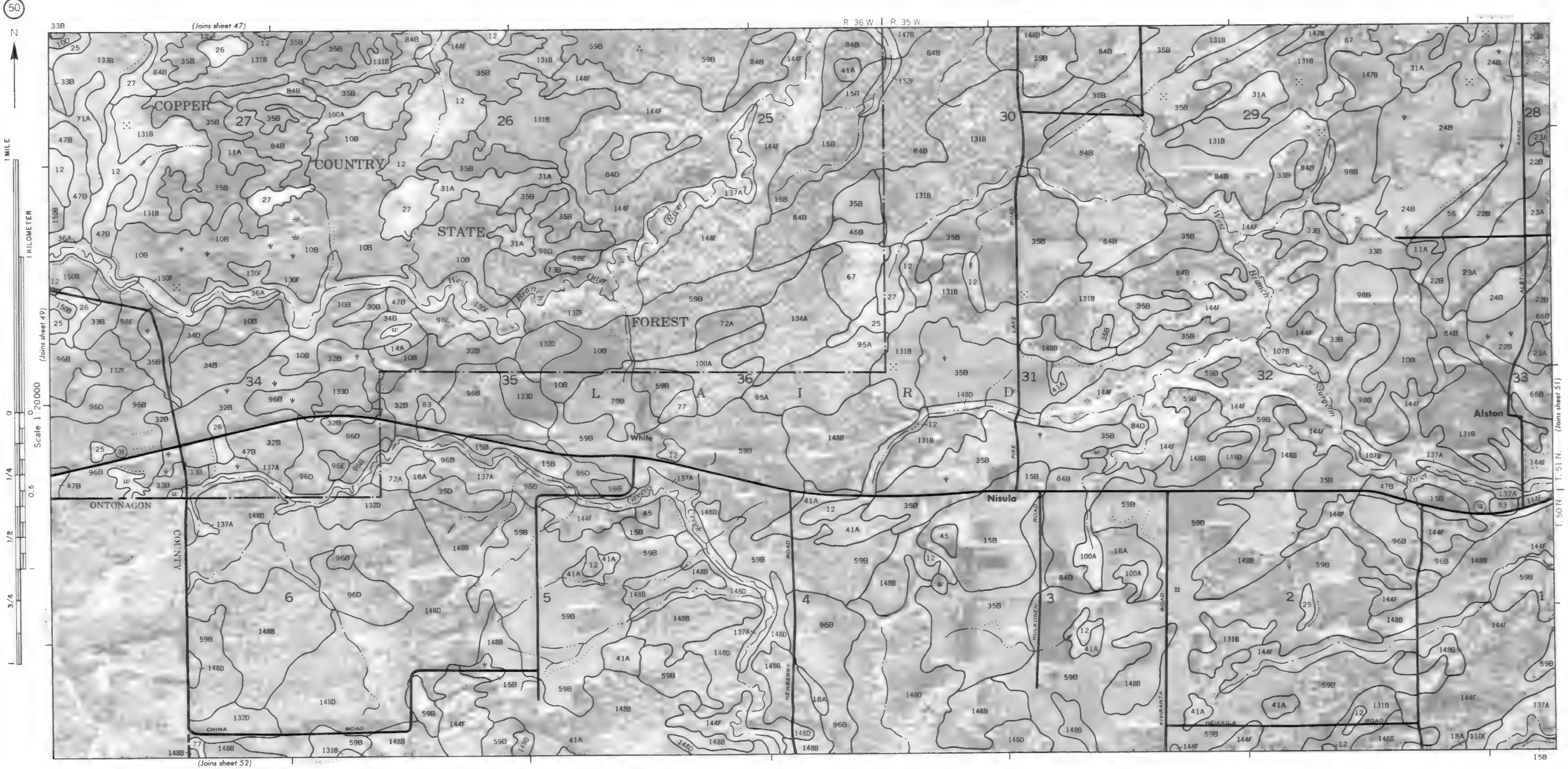



47
N
(Joins sheet 44)
(Joins sheet 48)
(Joins sheet 50)
(Joins inset, sheet 49)
R. 36 W. | R. 35 W.
T. 51 N.
Pike Lake
Lake Fifteen
COPPER
COUNTRY
ELM RIVER
STATE
FOREST
LAIRD
Bruno Creek
Fifteen Creek
Lake Fifteen Creek
West Branch
Otter River
PIKE LAKE ROAD
NORTH LAIRD ROAD
1 MILE
1 KILOMETER
Scale 1:20000

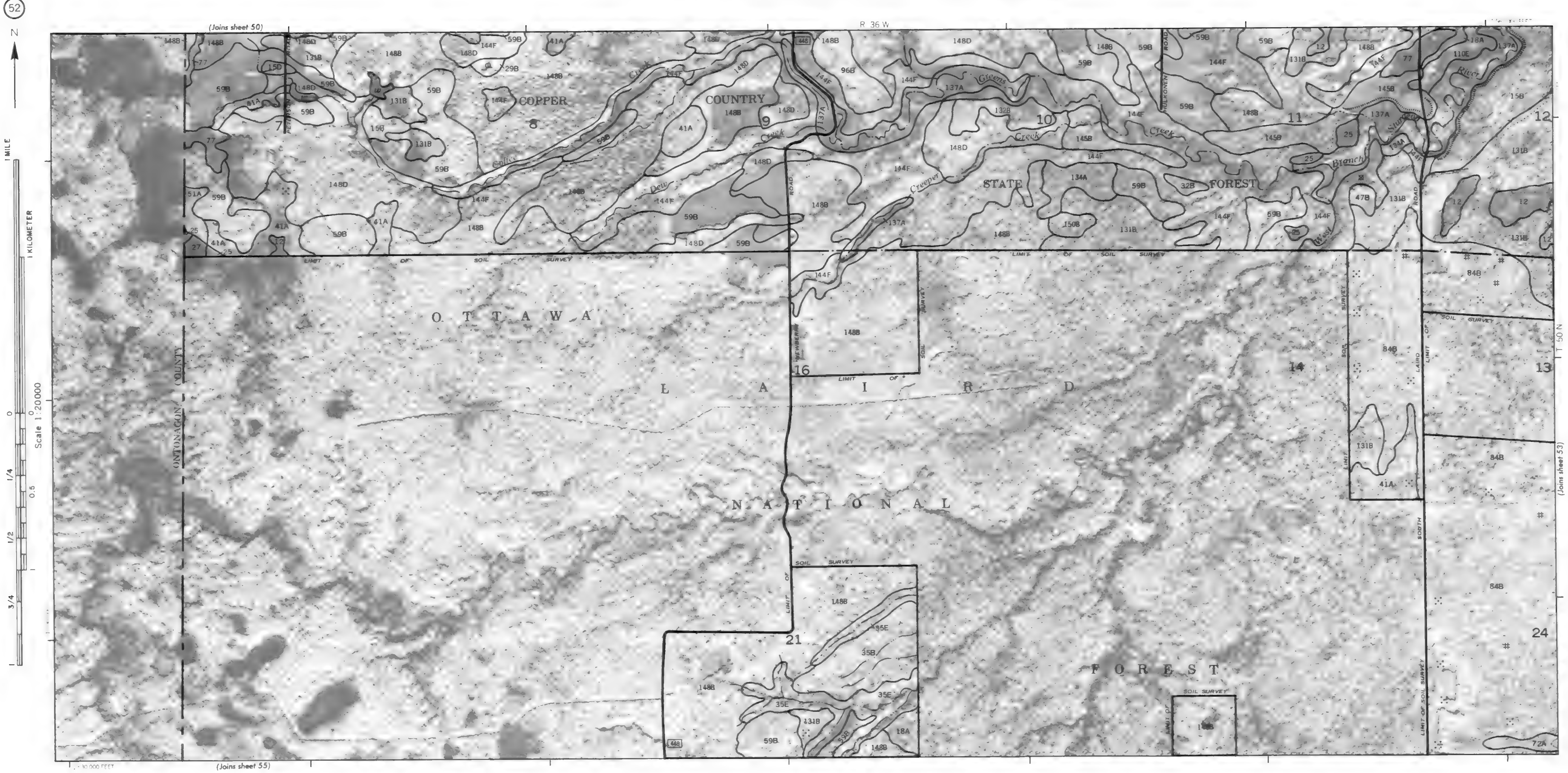

48
N
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 51)
R. 35 W. | R. 34 W.
T. 51 N.
1 MILE
1 KILOMETER
Scale 1:20000
COPPER
COUNTRY
STATE
FOREST
L A I R D
BARAGA COUNTY
Limestone Mountain
MOUNTAIN ROAD
LIMESTONE
NORTH LAIRD ROAD
West Branch Otter River
West Branch Sturgeon River
10
11
12
13
14
15
22
23
24

SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 49



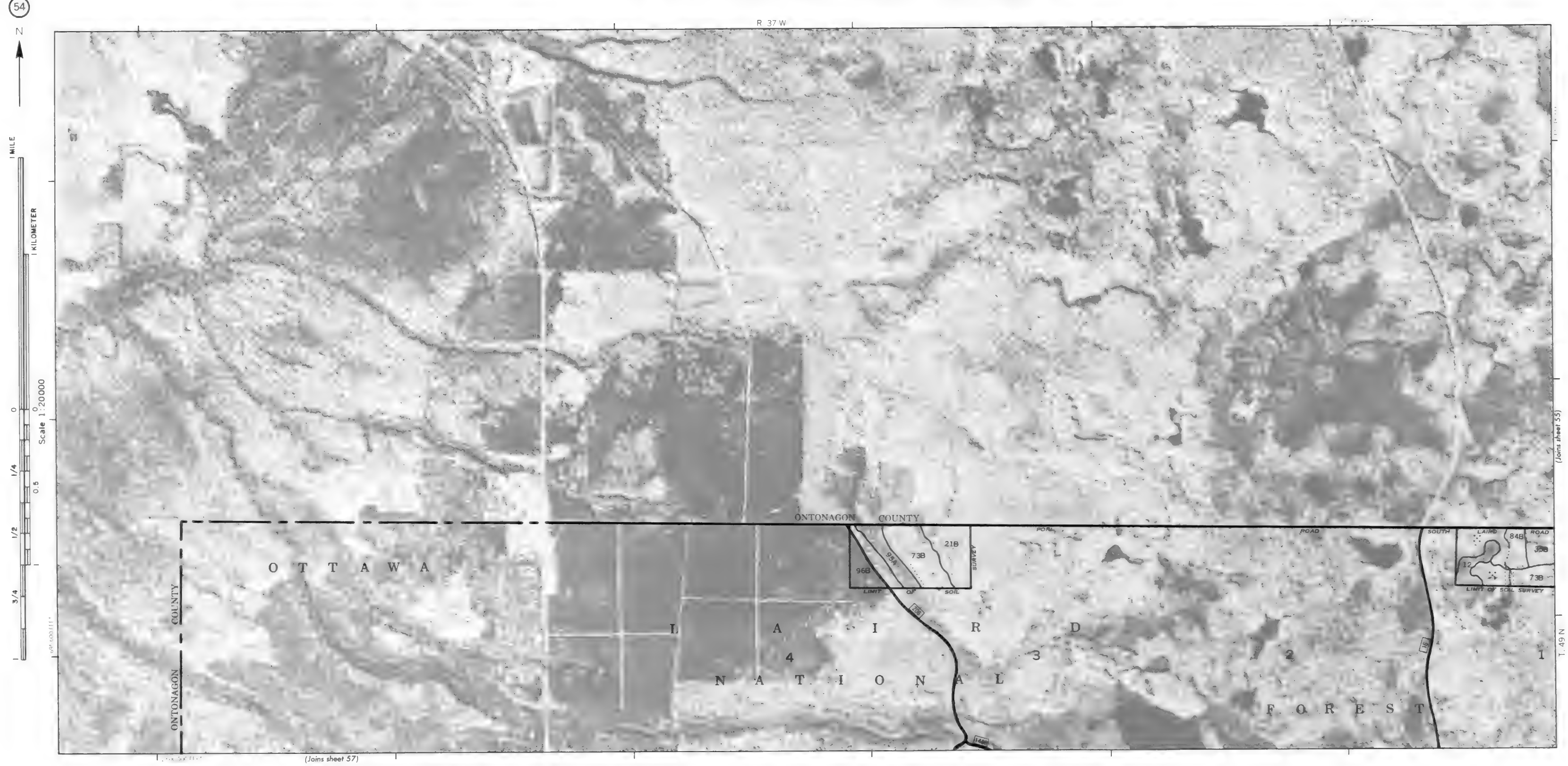

50
N
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 52)
R. 36 W. | R. 35 W.
T. 51 N. | T. 50 N.
1 MILE
1 KILOMETER
Scale 1:20000
COPPER COUNTRY STATE FOREST
LAIRD
ONTONAGON COUNTY
White
Nisula
Alston
West Branch Otter River
West Branch Sturgeon River
Greens Creek
LAKE ROAD
PIKE ROAD
NEWBERRY ROAD
HULKONEN ROAD
KIVIRANTA ROAD
CHINA ROAD
HEIKKILA ROAD
AVENUE
26
27
25
30
29
28
34
35
36
31
32
33
6
5
4
3
2
1


51
R. 35 W.
(Joins sheet 48)
(Joins sheet 50)
(Joins sheet 53)
T. 51 N.
T. 50 N.
L A I R D
OTTAWA
NATIONAL
FOREST
BARAGA COUNTY
KOPSI ROAD
HEIKKINEN ROAD
CLAYCO ROAD
NORTH LAIRD ROAD
HEIGHTS ROAD
CEMETERY ROAD
HAZEL ROAD
Sturgeon River
Silver River
West Branch
Forest Creek
Pine Creek
LIMIT OF SOIL SURVEY
water
27
26
25
34
35
36
6
5
4
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

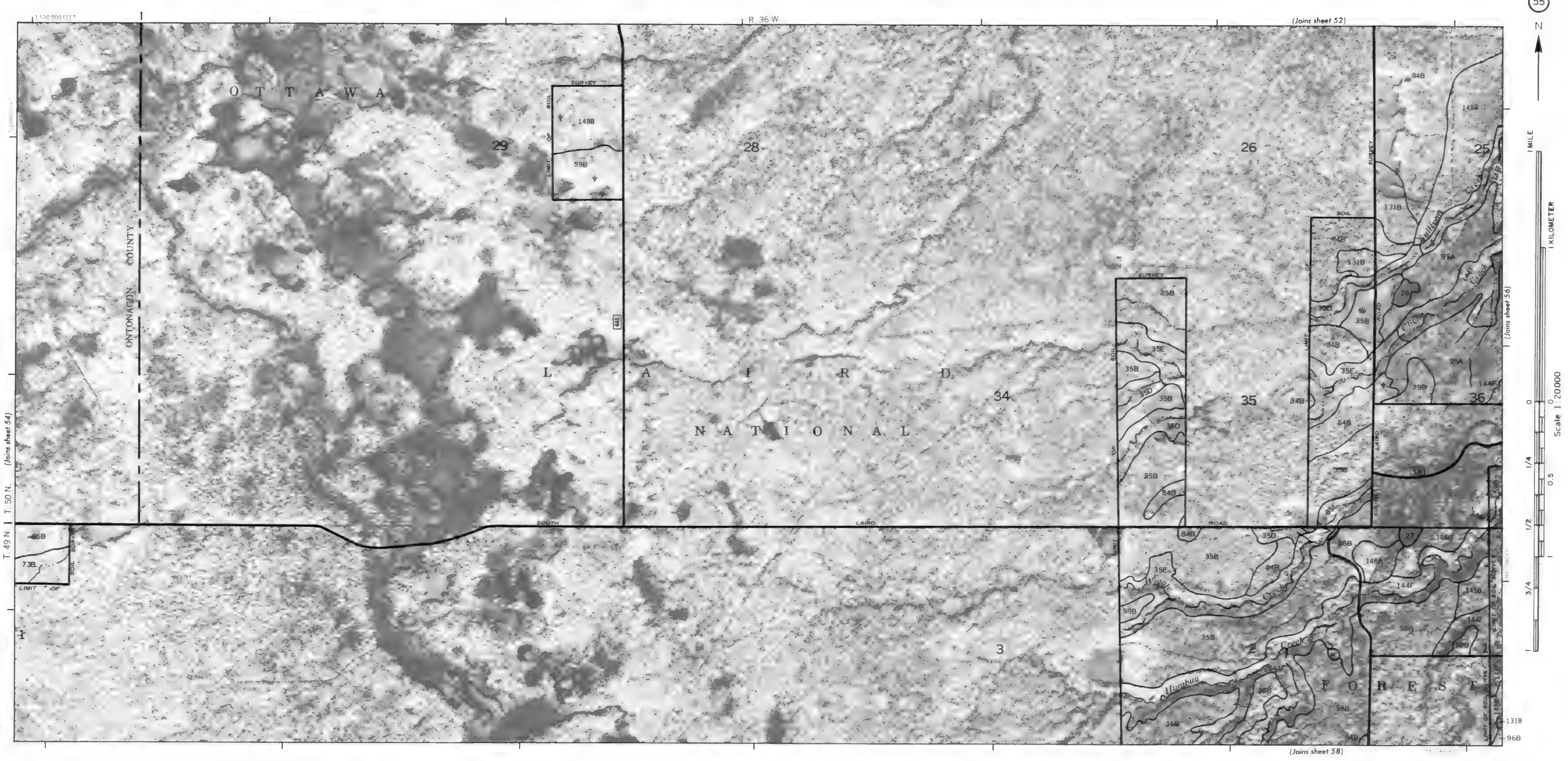

52
N
(Joins sheet 50)
R. 36 W.
COPPER
COUNTRY
STATE
FOREST
OTTAWA
LAIRD
NATIONAL
FOREST
ONTONAGON COUNTY
T. 50 N.
(Joins sheet 53)
(Joins sheet 55)
LIMIT OF SOIL SURVEY
Scale 1:20000
1 MILE
1 KILOMETER


53
N
R. 36 W.
R. 35 W.
T. 50 N.
(Joins sheet 51)
(Joins sheet 52)
(Joins sheet 56)
OTTAWA
LAIRD
NATIONAL
FOREST
BARAGA COUNTY
Prickett Lake
LIMIT OF SOIL SURVEY
12
8
9
13
17
16
18
24
20
19
21
1 MILE
1 KILOMETER
Scale 1:20000
193
15B
72A
73B
131B
12
27
41A
100A
35B
84B
59B
79B
31A
65A
58B
144F
13B
18A
51A
77
67
71A
96B
132F
47B
60E
150B

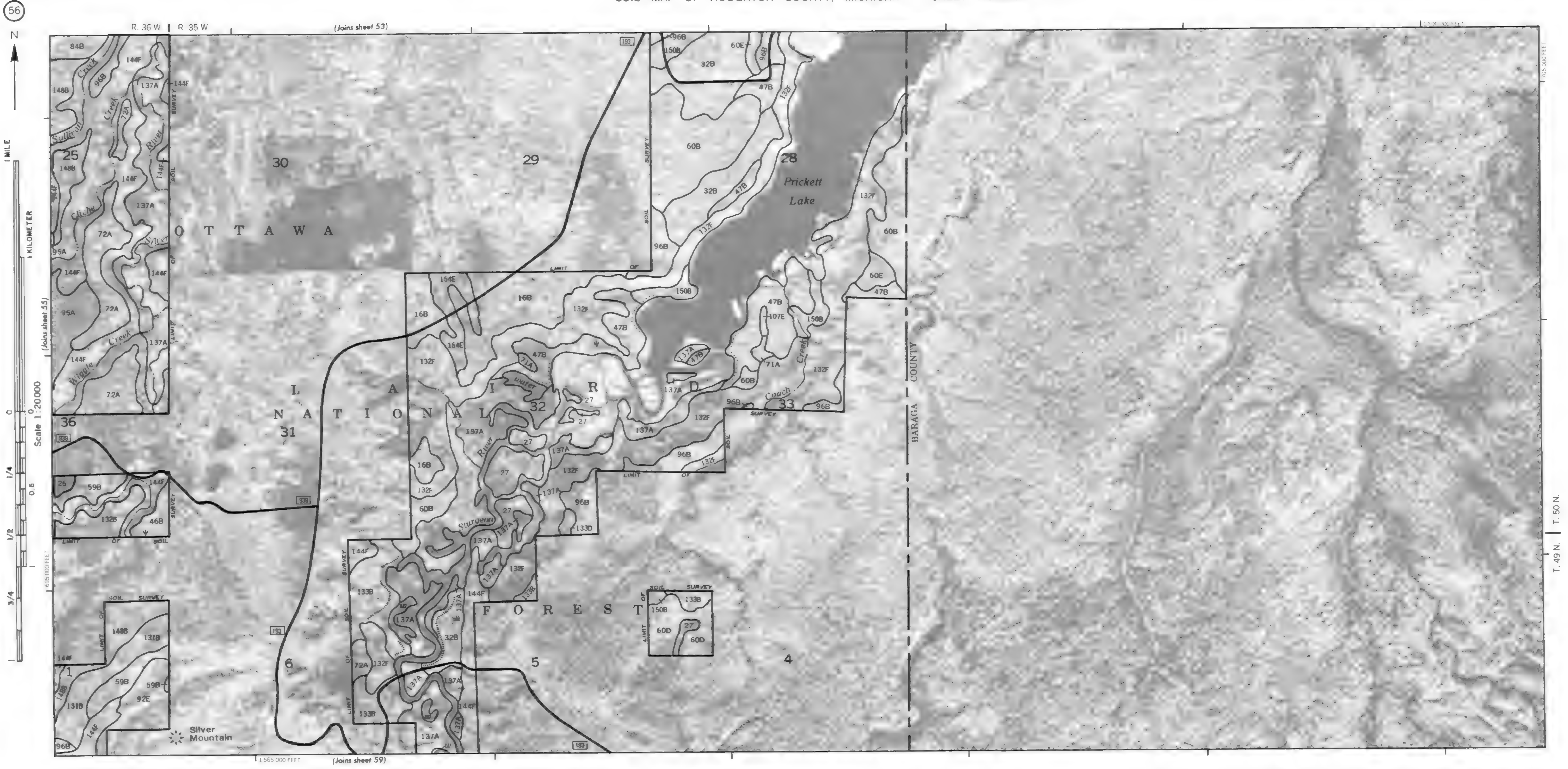
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 54

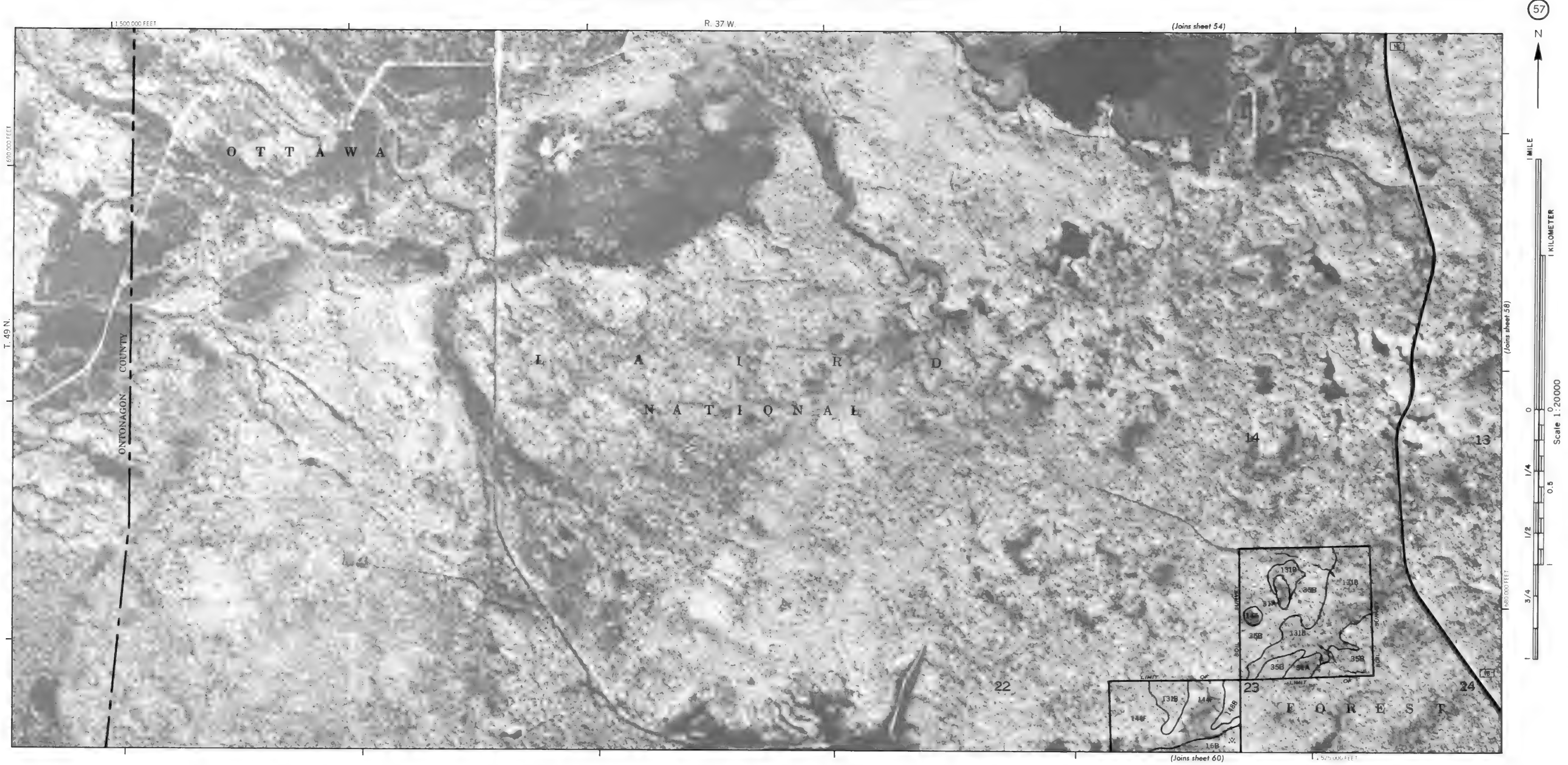


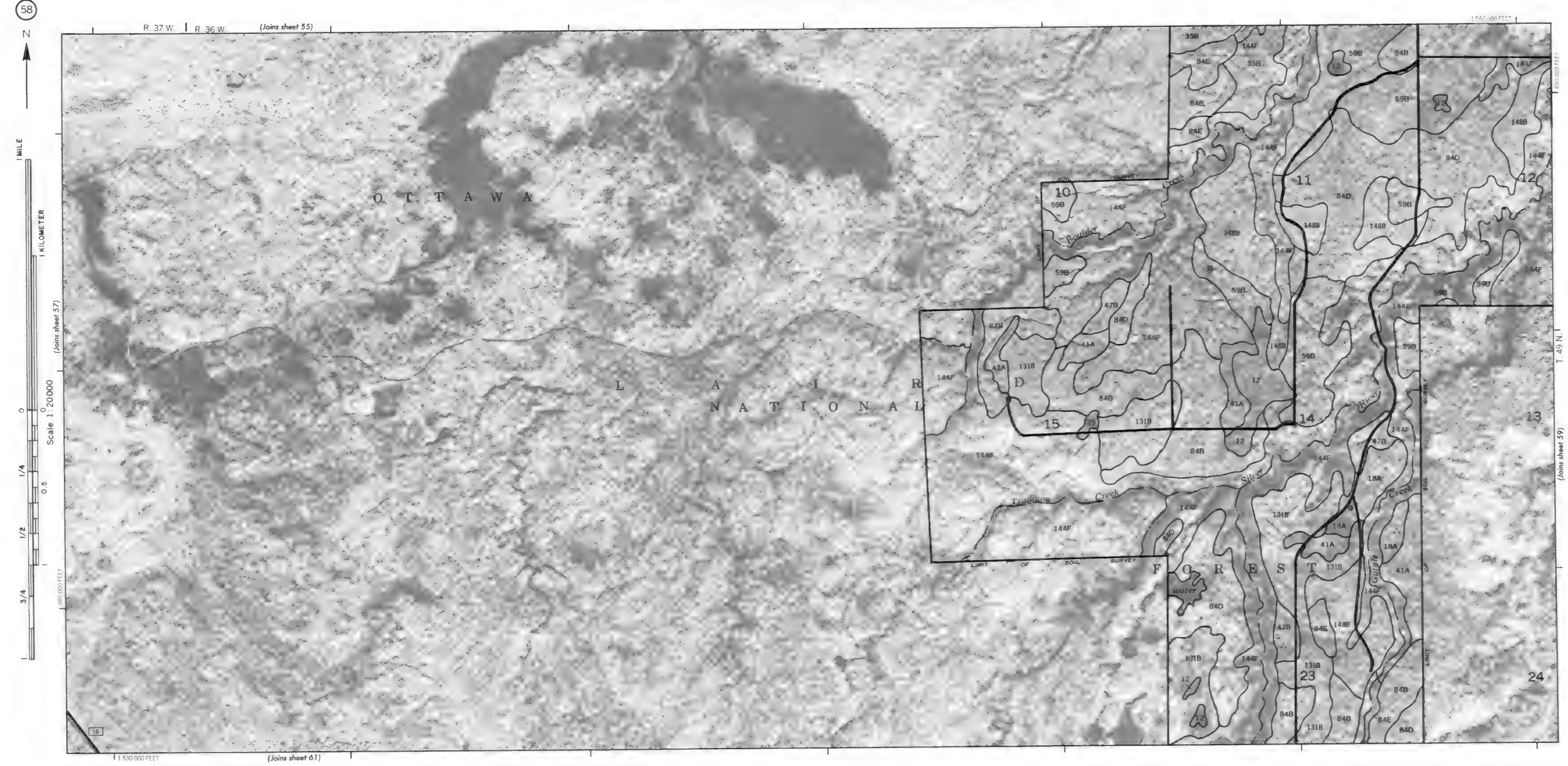
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 55

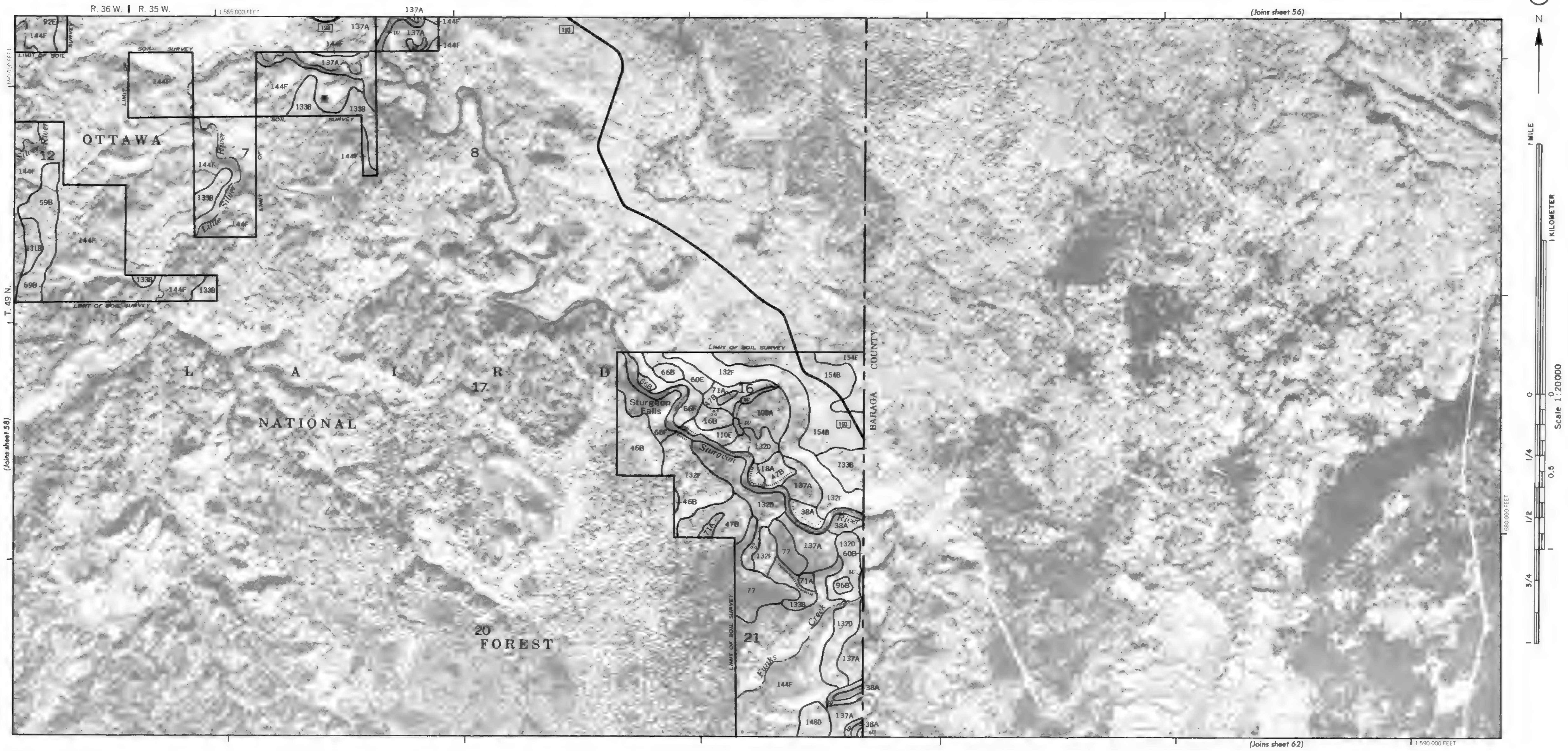


SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 56

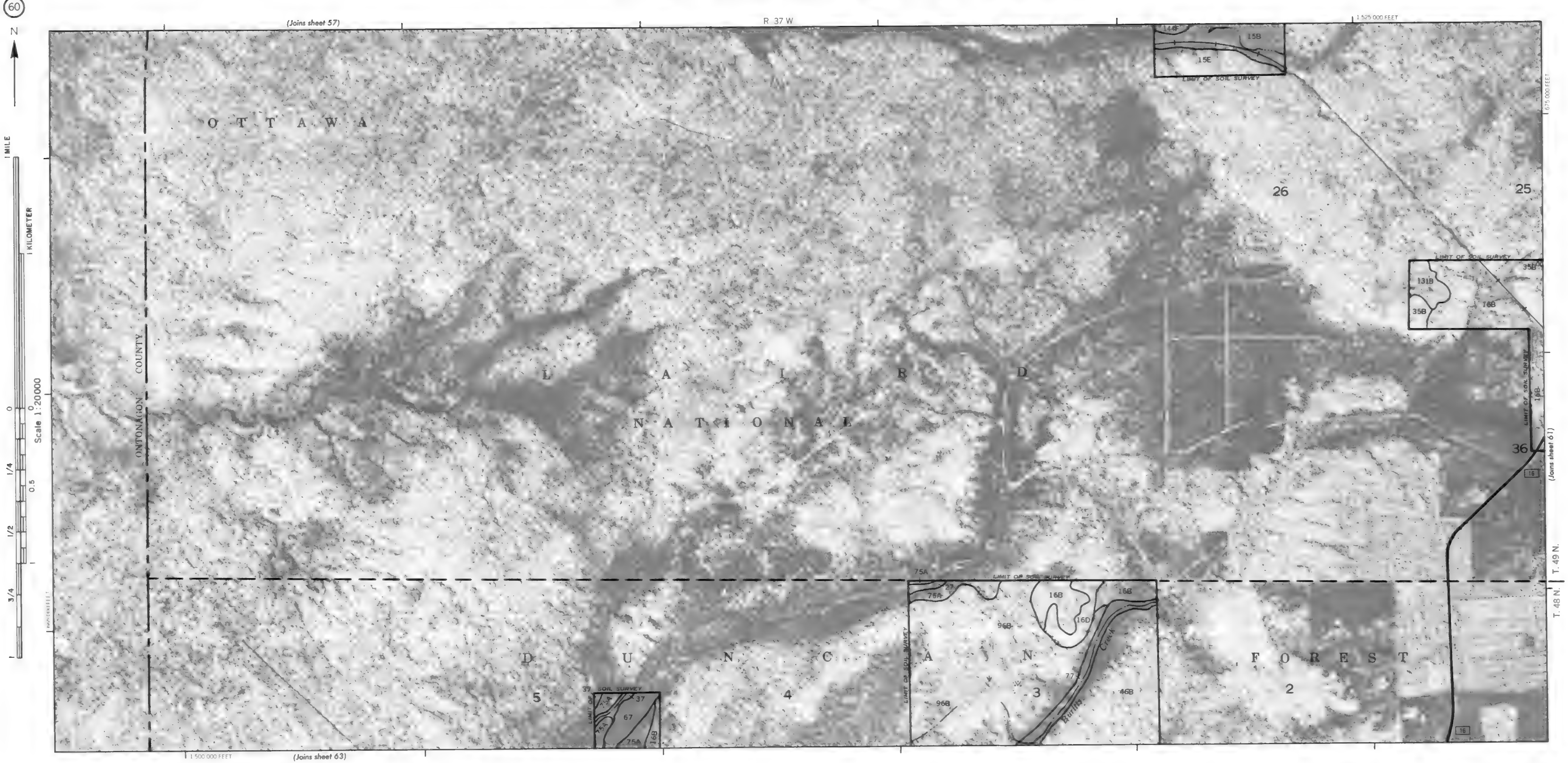


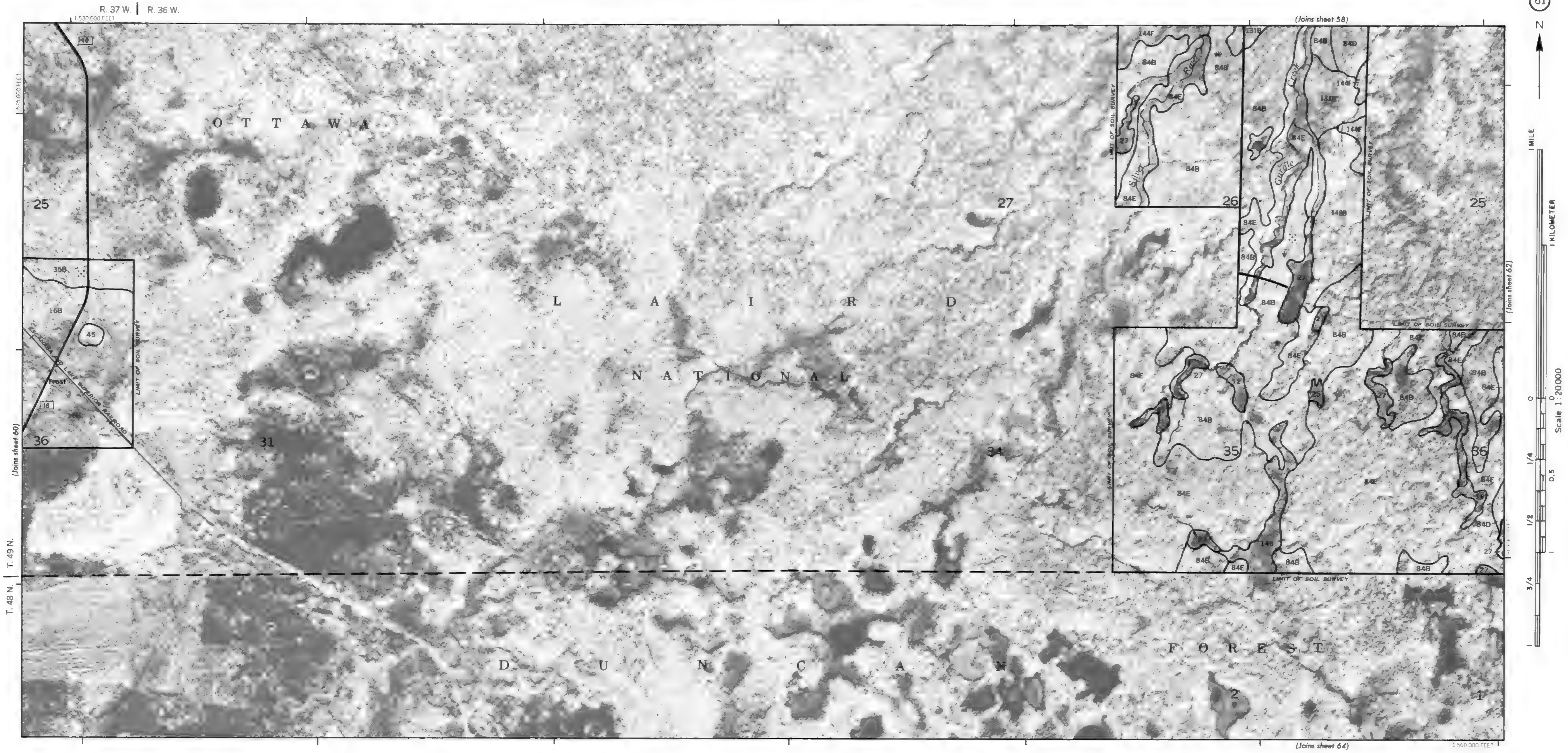

57
N
R. 37 W.
(Joins sheet 54)
T. 49 N.
O T T A W A
ONTONAGON COUNTY
L A I R D
N A T I O N A L
F O R E S T
(Joins sheet 58)
(Joins sheet 60)
14
13
22
23
24
131B
35B
14F
16B
18B
LIMIT OF SOIL SURVEY
1 MILE
1 KILOMETER
Scale 1:20000


58
N
R. 37 W.
R. 36 W.
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 61)
T. 49 N.
1 530 000 FEET
680 000 FEET
690 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
OTTAWA
NATIONAL
FOREST
Boulder Creek
Tradition Creek
Silver River
Gugle Creek
LIMIT OF SOIL SURVEY
water
10
11
12
13
14
15
23
24

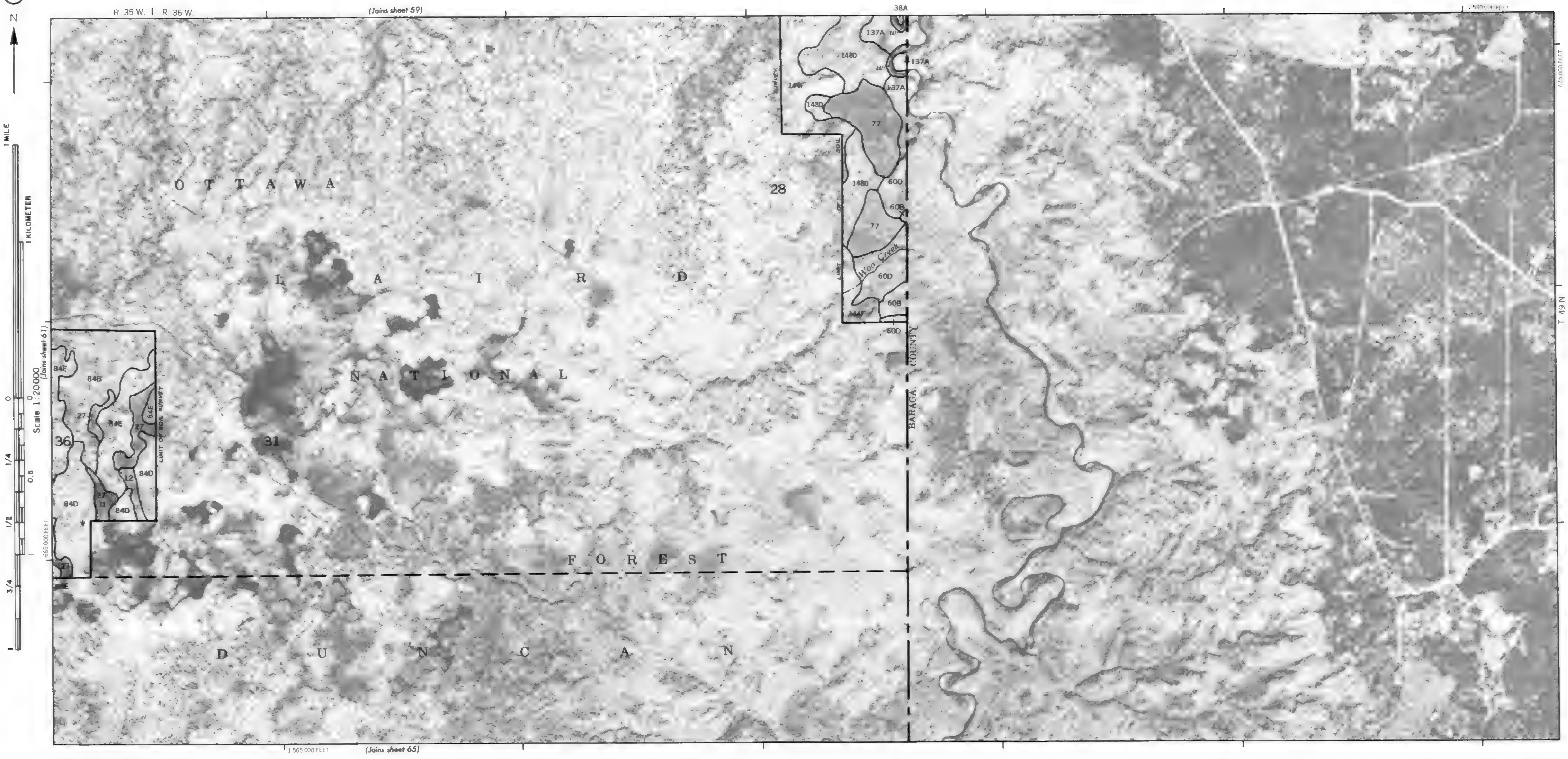

59
N
(Joins sheet 56)
(Joins sheet 58)
(Joins sheet 62)
R. 36 W.
R. 35 W.
T. 49 N.
OTTAWA
LAIRD
NATIONAL
FOREST
BARAGA COUNTY
LIMIT OF SOIL SURVEY
Sturgeon Falls
Sturgeon River
Little Silver River
Funks Creek
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
1 590 000 FEET
1 565 000 FEET
680 000 FEET

SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 60

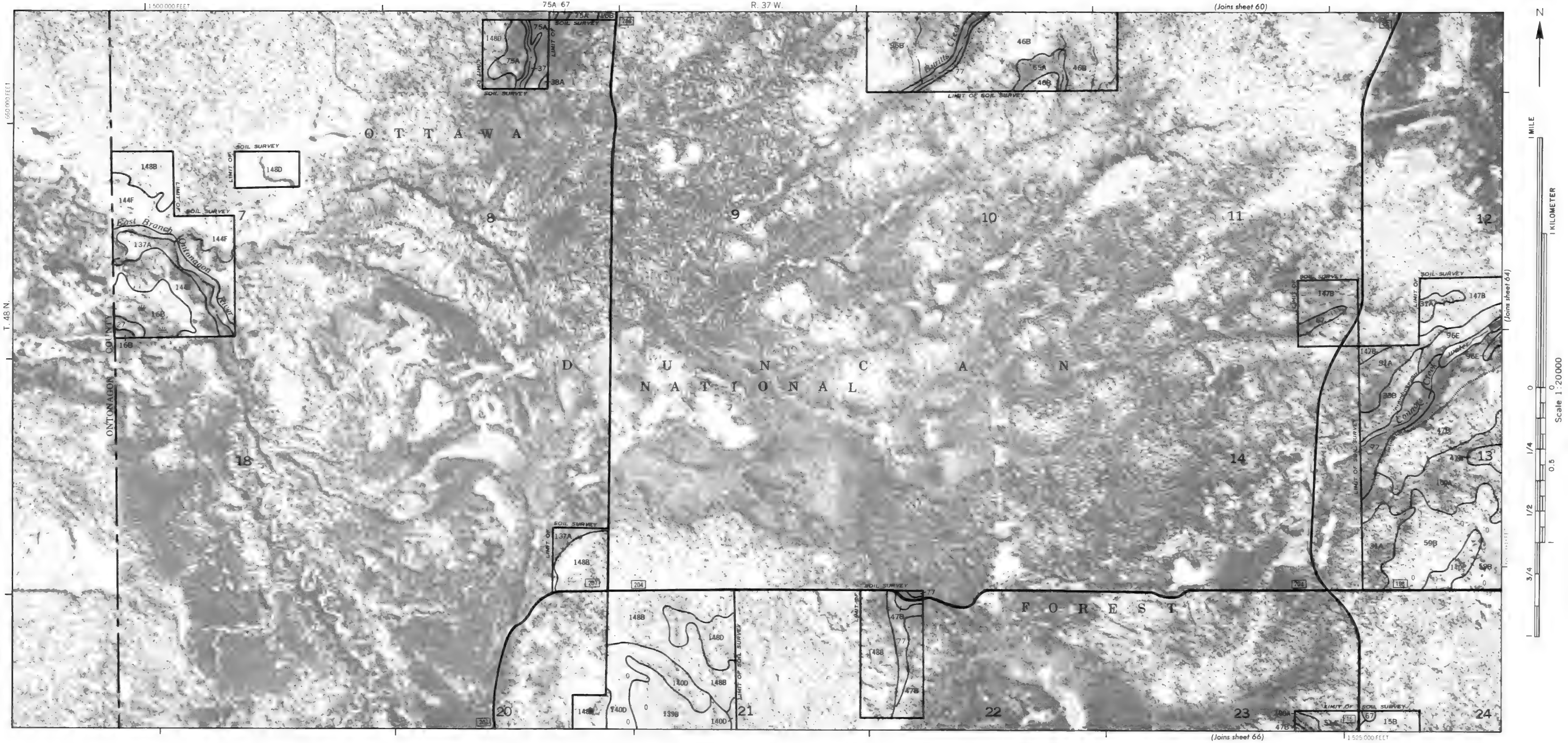


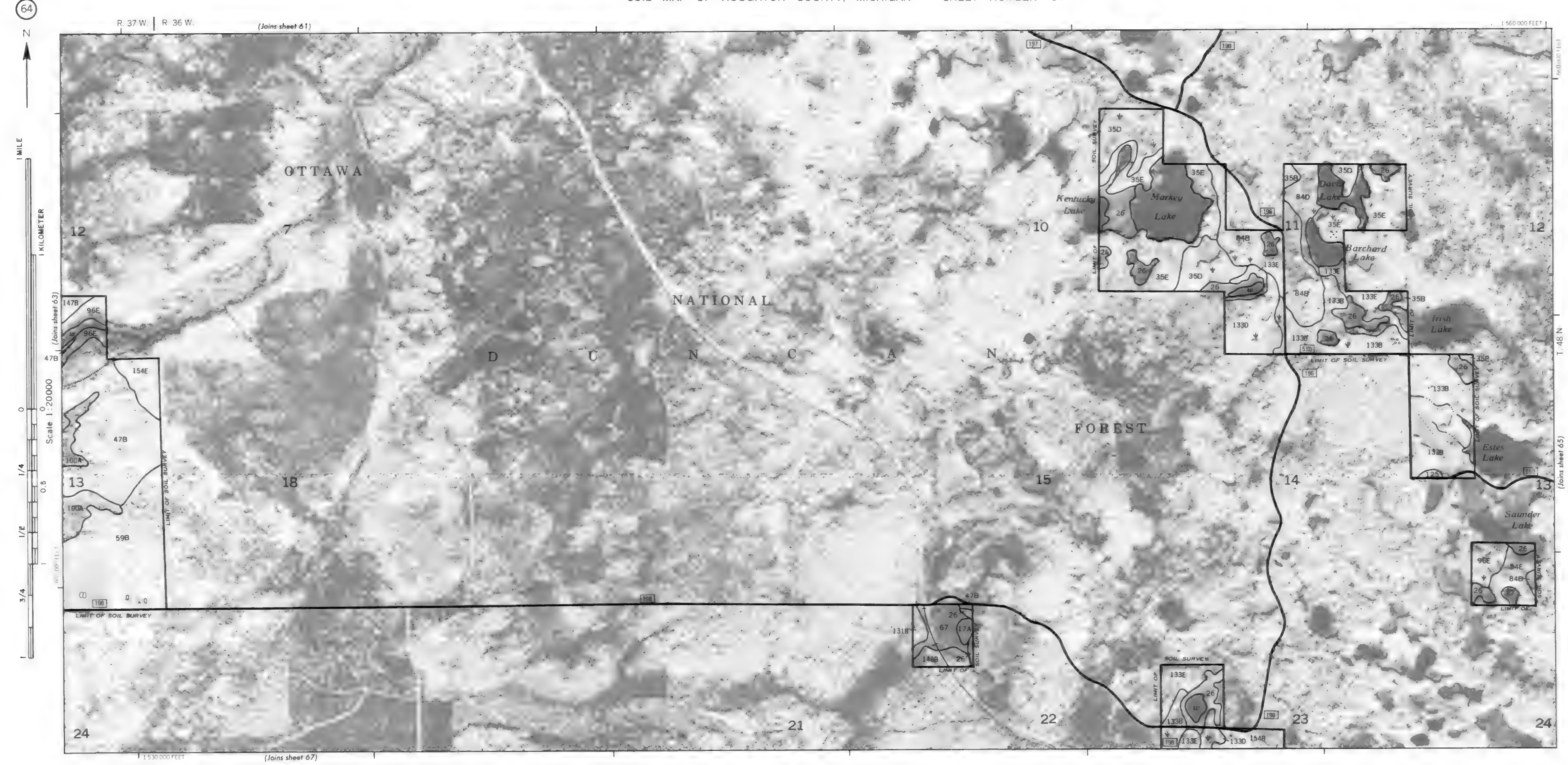

61
R. 37 W.
R. 36 W.
1 530 000 FEET
(Joins sheet 58)
(Joins sheet 60)
(Joins sheet 62)
(Joins sheet 64)
1 560 000 FEET
T. 49 N.
T. 48 N.
O T T A W A
L A I R D
N A T I O N A L
D U N C A N
F O R E S T
LIMIT OF SOIL SURVEY
ESCANABA AND LAKE SUPERIOR RAILROAD
Frost
Silver River
Gomanche Creek
25
36
31
27
34
26
35
2
1
35B
16B
45
84B
84E
84D
144F
131B
148
27
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
0.5
1/2
3/4
1

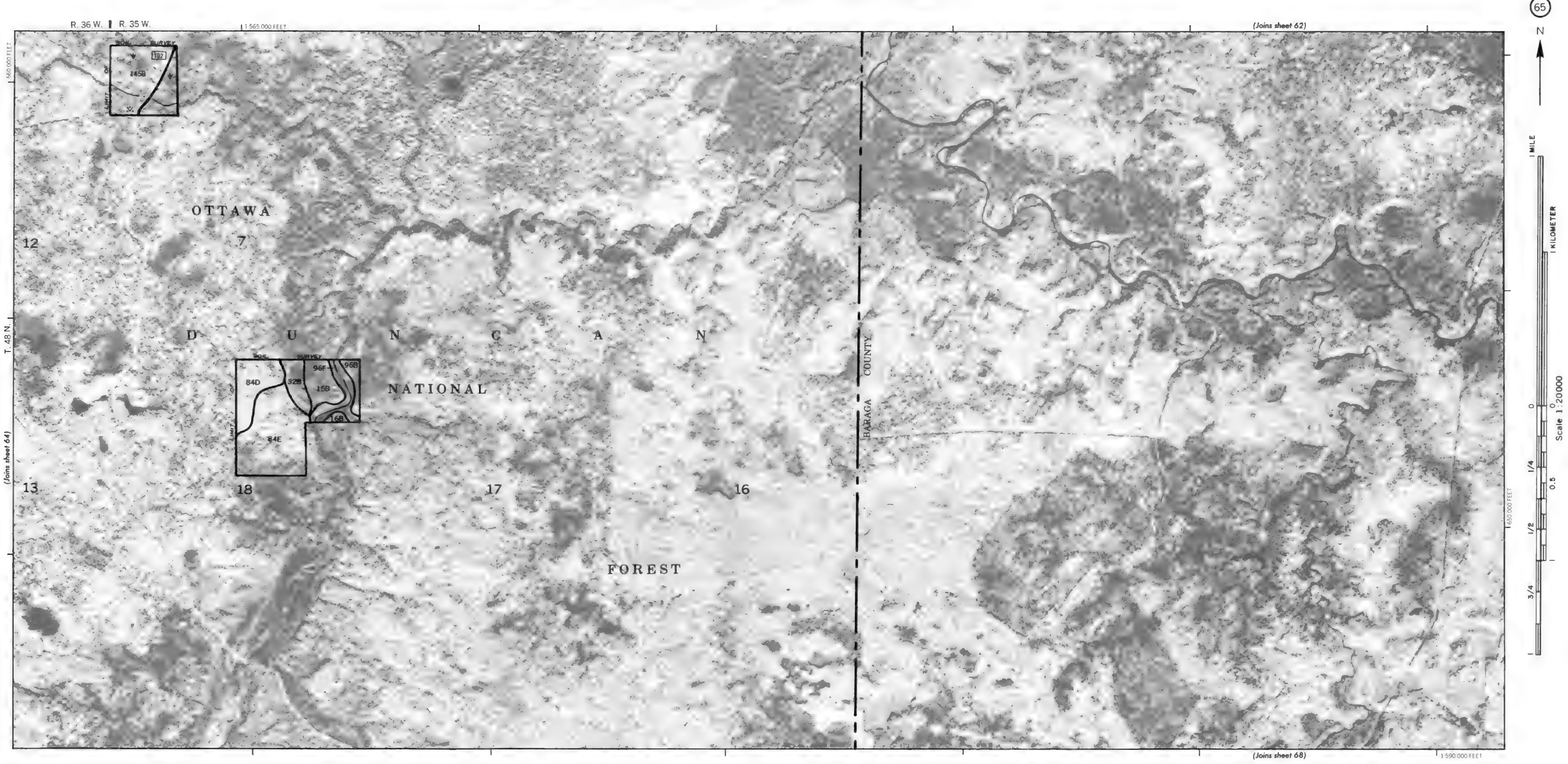
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 62



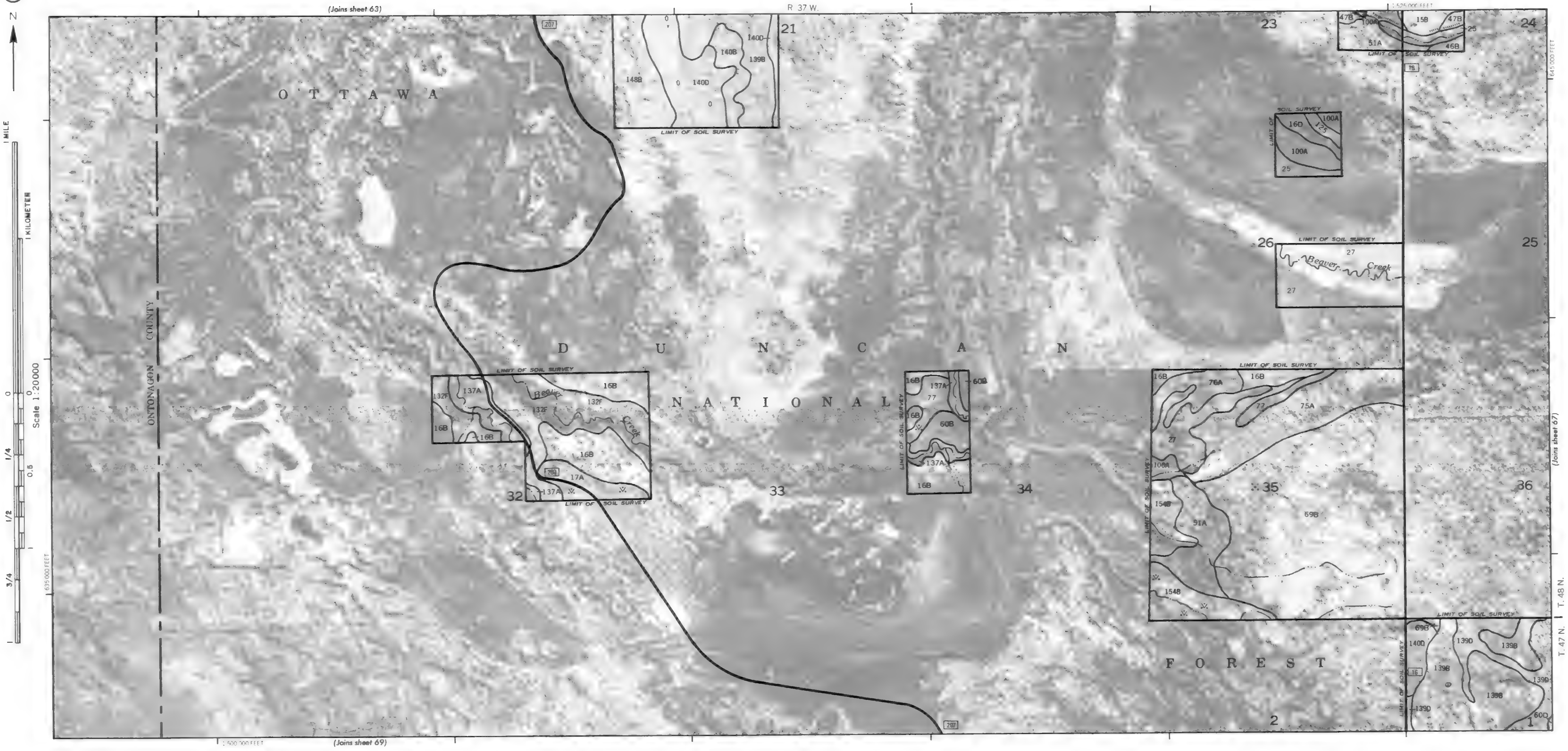
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 63

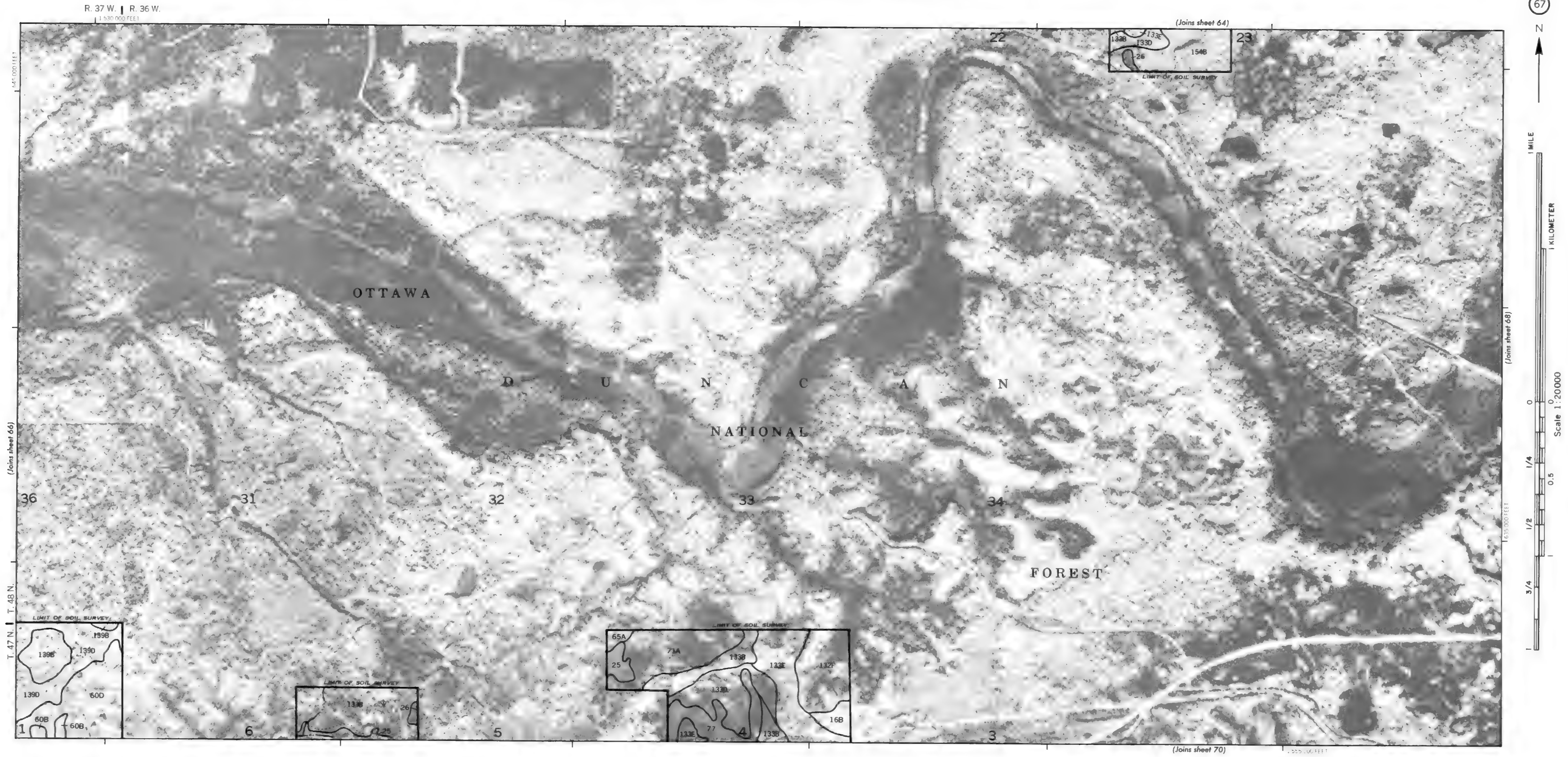



64
N
R. 37 W.
R. 36 W.
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 65)
(Joins sheet 67)
1 560 000 FEET
1 530 000 FEET
T. 48 N.
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
OTTAWA
NATIONAL
D U N C A N
FOREST
12
7
10
11
12
13
18
15
14
13
24
21
22
23
24
Kentucky Lake
Markey Lake
Davis Lake
Barchard Lake
Irish Lake
Estes Lake
Saunder Lake
LIMIT OF SOIL SURVEY
197
198
196
550
147B
96E
47B
154E
100A
59B
35D
35E
35B
84D
84B
26
133E
133D
133B
67
17A
131B
148B
154B
84E
w

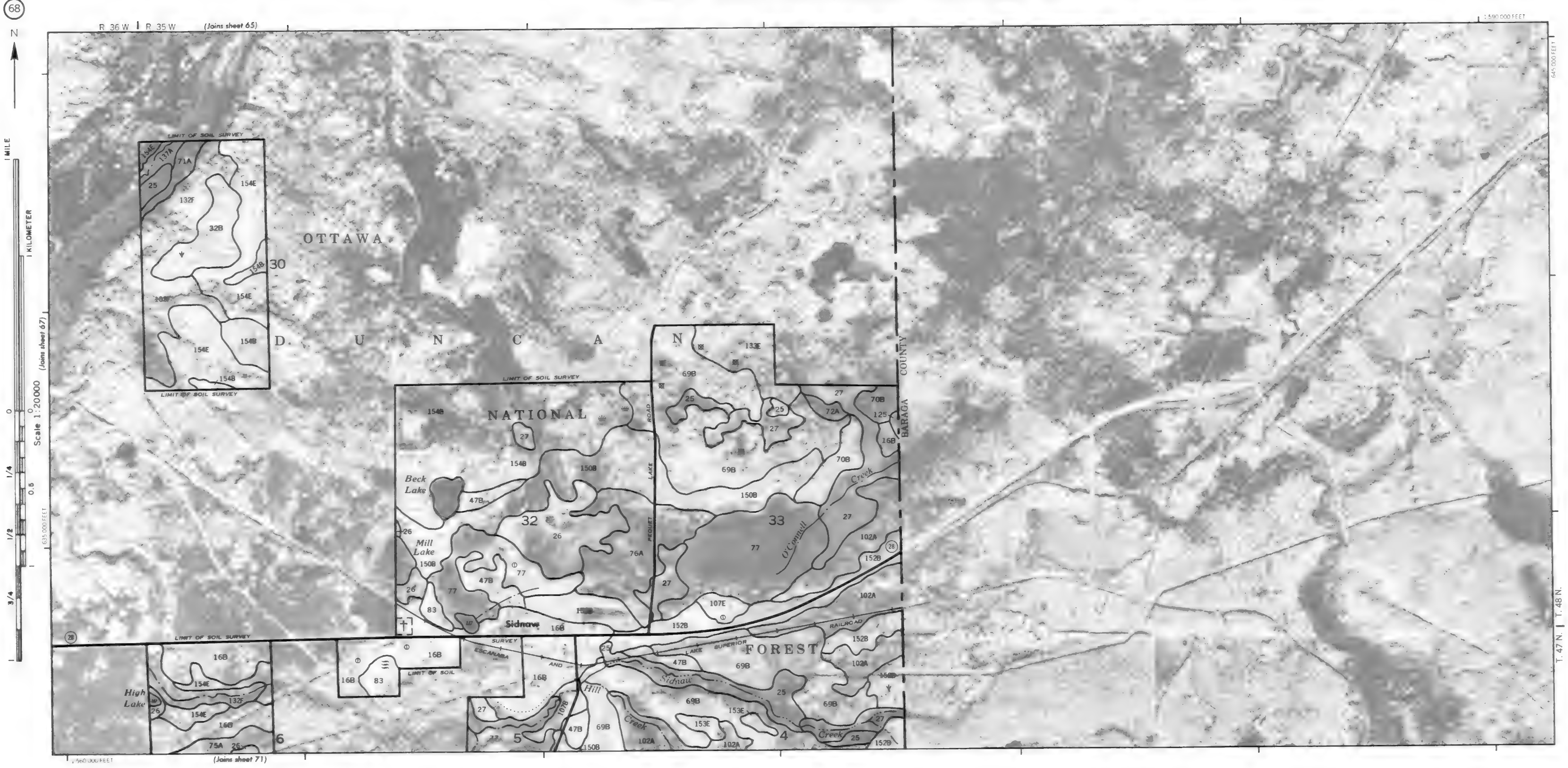

65
N
R. 36 W.
R. 35 W.
(Joins sheet 62)
(Joins sheet 64)
(Joins sheet 68)
T. 48 N.
OTTAWA
D U N C A N
NATIONAL
FOREST
BARAGA COUNTY
12
7
13
18
17
16
84D
32B
96F
96B
16B
84E
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 66

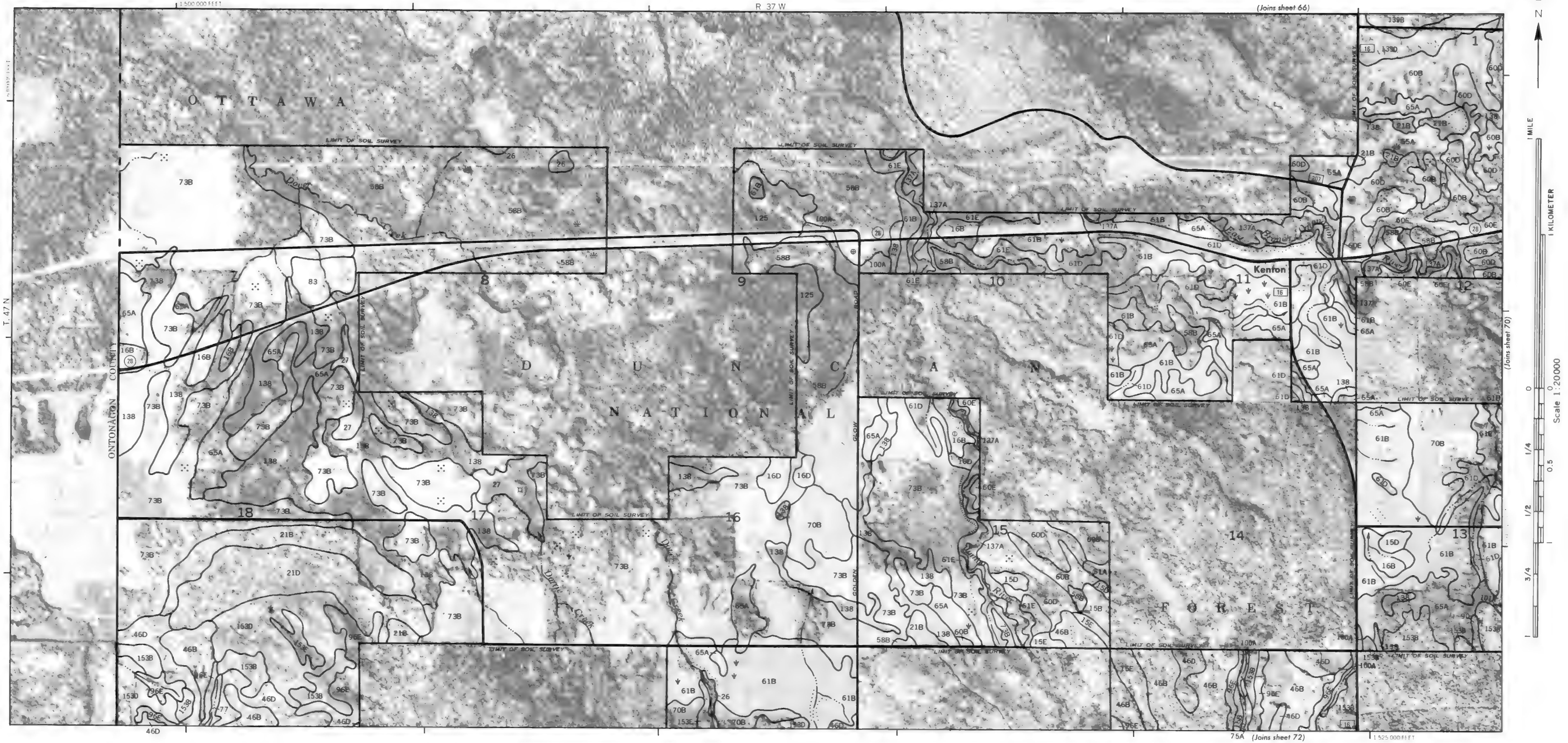



67
N
R. 37 W.
R. 36 W.
(Joins sheet 64)
(Joins sheet 66)
(Joins sheet 68)
(Joins sheet 70)
T. 48 N.
T. 47 N.
OTTAWA
D U N C A N
NATIONAL
FOREST
22
23
36
31
32
33
34
1
6
5
4
3
LIMIT OF SOIL SURVEY
133B
133E
133D
26
154B
139B
139D
60D
60B
25
65A
71A
133F
16B
77
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

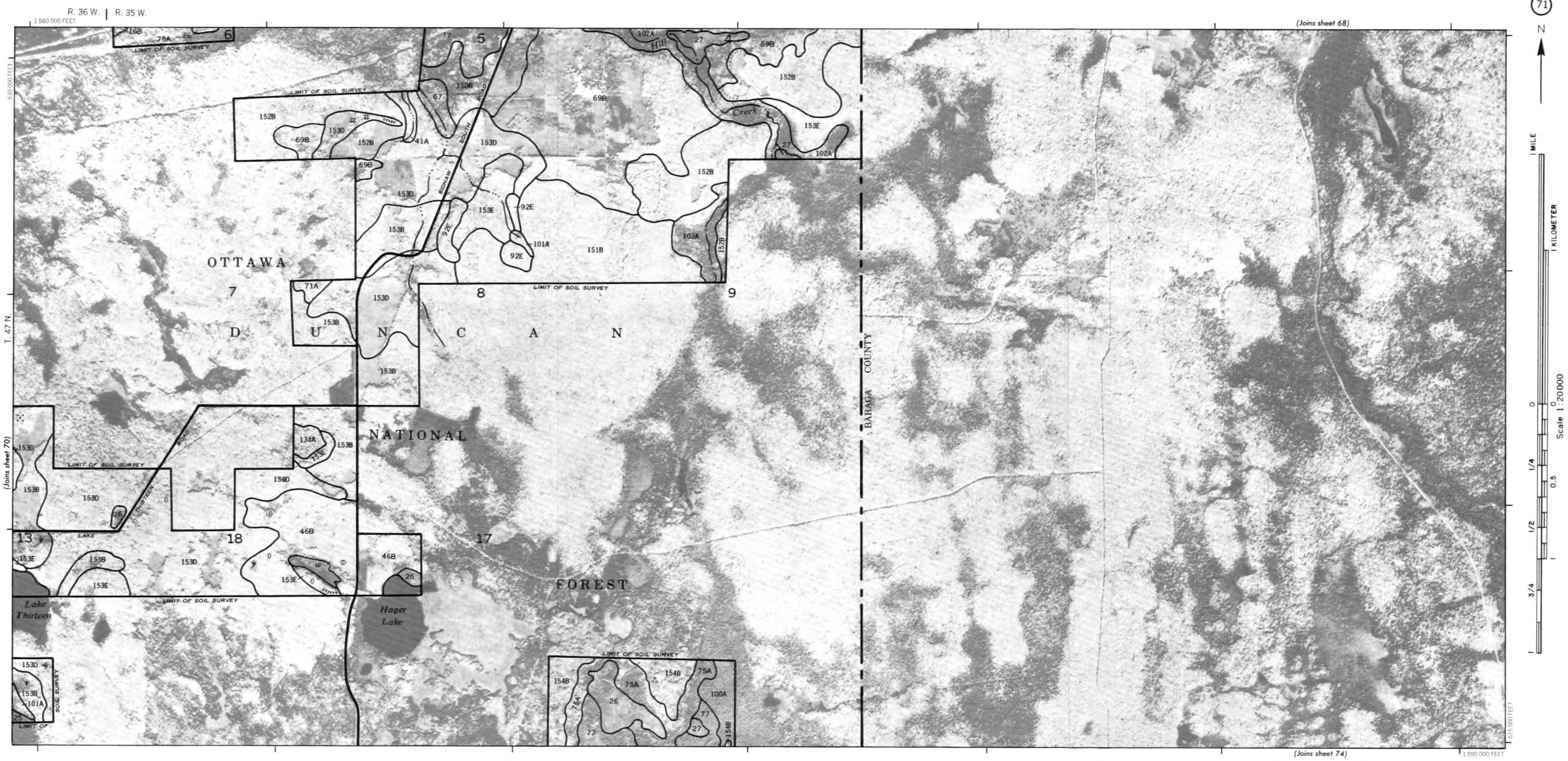
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 68

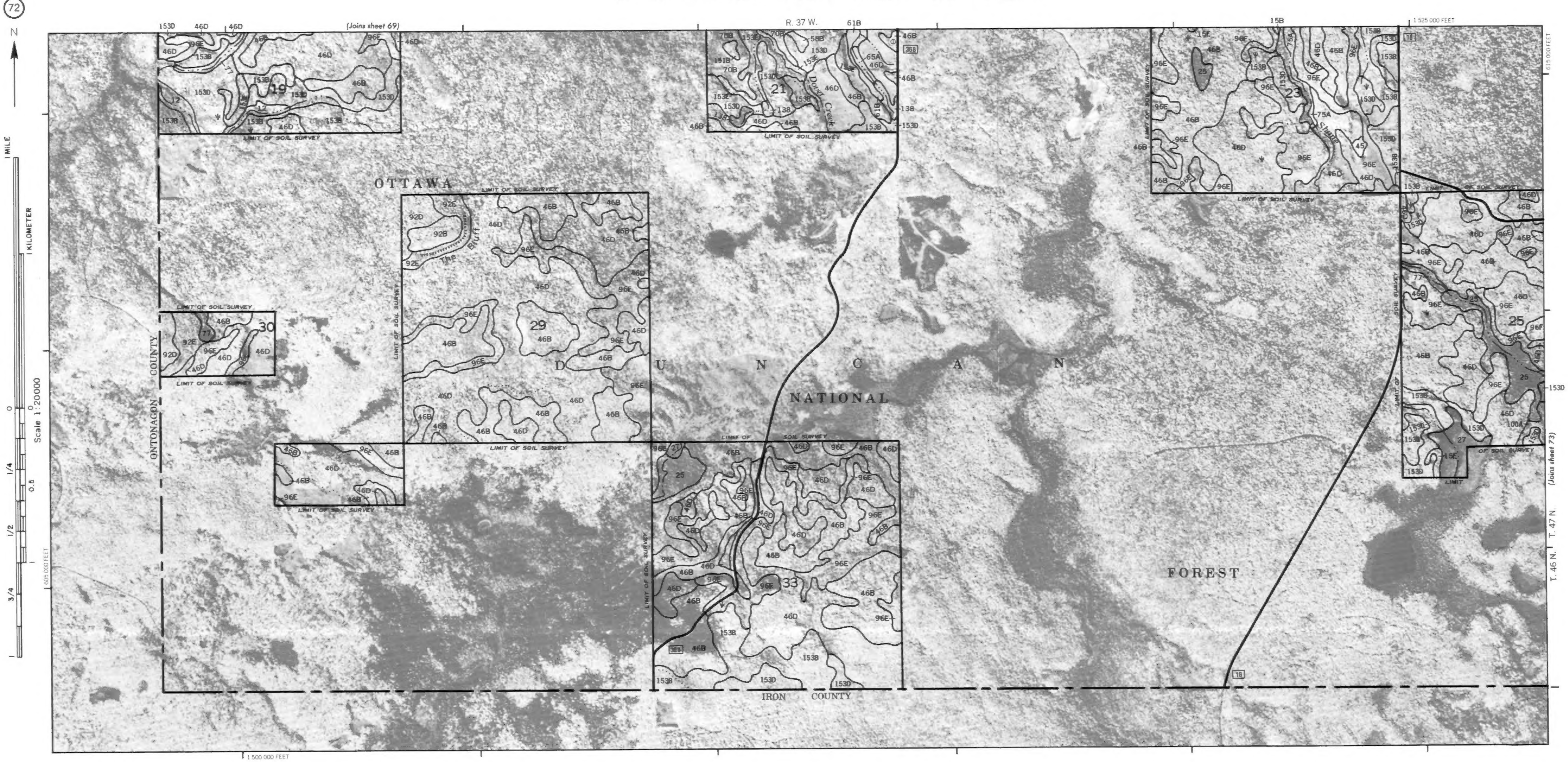


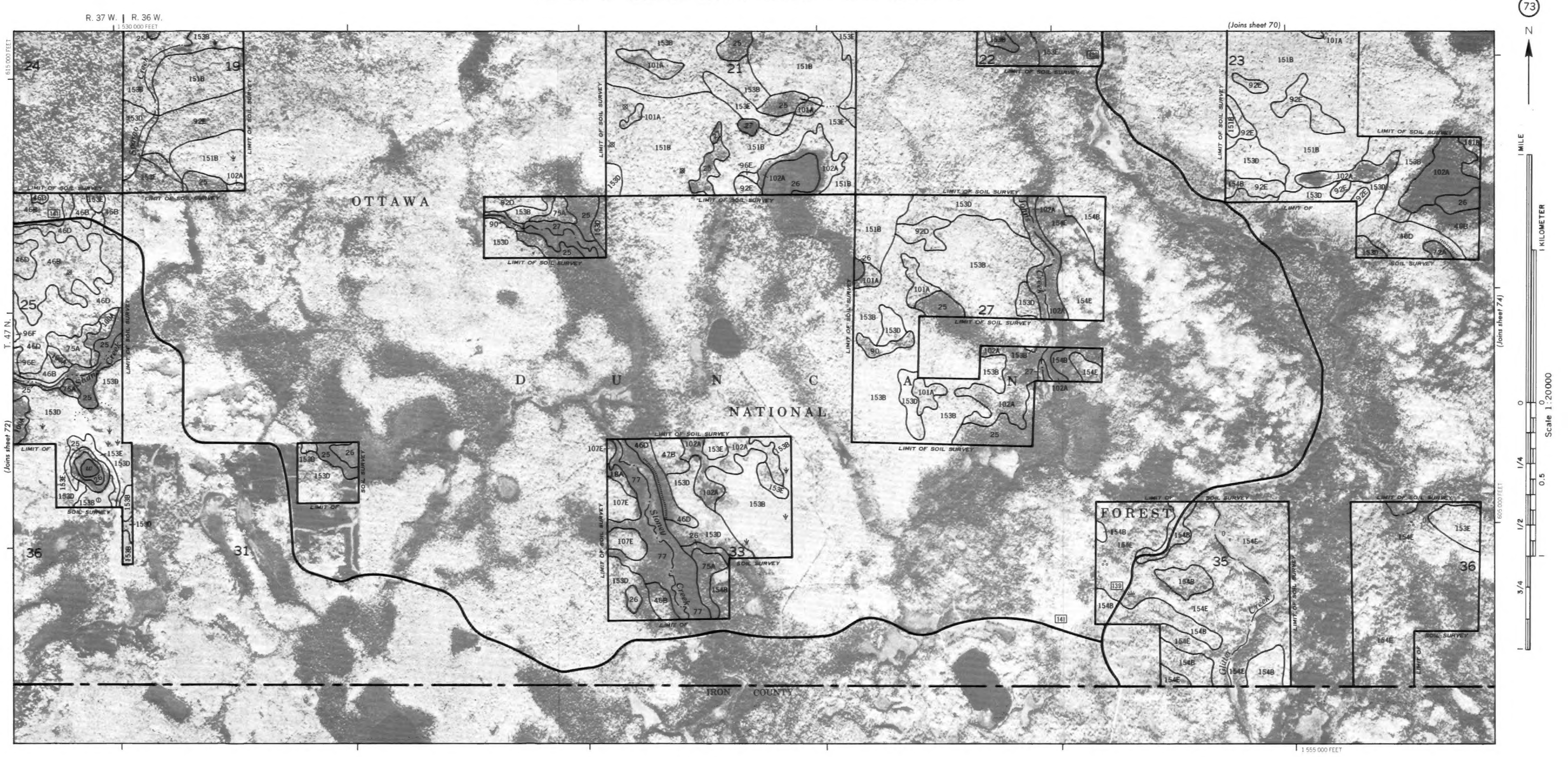
SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 69



SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 70


R. 36 W.
R. 35 W.
1 560 000 FEET
(Joins sheet 68)
(Joins sheet 70)
(Joins sheet 74)
630 000 FEET
615 000 FEET
1 590 000 FEET
T. 47 N.
71
N
OTTAWA
DUNCAN
NATIONAL
FOREST
BARAGA COUNTY
LIMIT OF SOIL SURVEY
SIDNAW
SOUTH
ROAD
THIRTEEN
LAKE
ROAD
Hill
Creek
Lake Thirteen
Hager Lake
5
4
6
7
8
9
13
17
18
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5


72
N
(Joins sheet 69)
R. 37 W.
1 525 000 FEET
615 000 FEET
605 000 FEET
1 500 000 FEET
(Joins sheet 73)
T. 47 N.
T. 46 N.
OTTAWA
NATIONAL
FOREST
D U N C A N
ONTONAGON COUNTY
IRON COUNTY
LIMIT OF SOIL SURVEY
The Bluff
Dago Creek
Big
Sharon
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
19
21
23
25
29
30
33


73
R. 37 W.
R. 36 W.
1 530 000 FEET
(Joins sheet 70)
T. 47 N.
(Joins sheet 72)
(Joins sheet 74)
OTTAWA
D U N C A N
NATIONAL
FOREST
IRON COUNTY
LIMIT OF SOIL SURVEY
605 000 FEET
615 000 FEET
1 555 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
1

SOIL MAP OF HOUGHTON COUNTY, MICHIGAN — SHEET NUMBER 74